The Builder.

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House, Hadley Road, Middlesex ..... Mr. Alfred H. Hart, A.R.I.B.A., Architect.
South Herts Golf Club House ..... Mr. A. C. Dickie, A.R.I.B.A., and Mr. W. Curtis Green, Architects.
House, Farnboro' ..... Mr. Paxton H. Watson, Architect.
Sanatorium, Shrewsbury School ..... Mr. Keith D. Young, F.R.I.B.A., Architect.

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Ancient Chaldean Irrigation.

SO persistently does modern literature, both technical and general, force itself upon the attention of the world, that things of the past are almost crowded out. Men of the present day are too apt to forget great deeds wrought and great works done in early days, and proud in the enjoyment of privileges bestowed by modern engineering science, are almost persuaded that they, as individuals, have had some share in creating, or are in some way responsible for, the marvels of the twentieth century. Even if it were right for those of the rank and file to identify themselves in this facile way with the results of modern science, it would still be a mistake to believe that human intelligence in itself is essentially greater than it was thousands of years ago. Knowledge has certainly increased, bringing in its train vastly increased resources, so that a task may now be accomplished in a few days that formerly would have required as many years. Yet, many works that are now regarded as masterpieces of modern engineering skill have been equalled, if not surpassed, in nearly forgotten ages. Within recent months volumes have been written upon Nile irrigation works in papers of all kinds, from serious technical journals down to fashion books, probably leading the average man or woman to form the opinion that no works of similar magnitude were ever before conceived or realised. It is forgotten, or has never been known, by such people that basin irrigation, as practised in Egypt and elsewhere 7,000 years or more ago, is even now the most efficacious method of treating some lands, and that perennial irrigation, sometimes thought to be a modern invention, is of great antiquity. Moreover, some of the most gigantic engineering works of former times are unknown to many people, even by repute. As examples of comparatively unknown achievements, we may cite some remarkable engineering works of which the remains are still to be found in Yemen, the ancient home of the Sabæans. One of these is the ruined masonry dam at Mareb, or Sheba, the original capital of the country. This work is supposed to have been built by Lokmán, in the year 1700 B.C., and according to M. d'Arnaud, a well-known French traveller, it consists of a great masonry wall, 2 miles long and 175 paces wide, connecting two hills. In another account, it is said to be 2 miles long by 500 ft. thick by 120 ft. high. Its object was the storage of water for irrigation, and regulation was effected by sluices at different heights, so that supplies might be maintained irrespective of the water levels in the reservoir. At Hirran, in the same region, there exist the ruins of an ancient masonry dam, connecting two spurs of a hill, this work being 150 yds. long, 20 ft. high, and wide enough to permit the passage of a carriage and pair along the top. There are also the remains of several deep wells, whose object was evidently the provision of water for the garrison of an early fortress.

Interesting as these remains undoubtedly are, the ancient irrigation works of Chaldea are still more noteworthy, and they acquire additional importance from the fact that the Bagdad railway, which it is proposed shall be built along the Euphrates and Tigris valleys, will have the effect of throwing open the country to Western civilisation. Bagdad, the ancient capital of the Kaliphs, inaptly named "The Abode of Peace," lies in the midst of a desolate waste that was once a densely populated and highly-cultivated region. To the north at Dura, was the upper intake of the ancient Nahrwân Canal, and there the golden image was set up by Nebuchadnezzar. Tel Alig, where died the Emperor Julian, lies in ruins a few miles to the south of Dura. Next come Opis, once the wealthiest emporium of the East; the ruins of Ctesiphon, where the great arch of Nausherwan's palace still stands in witness to the faded magnificence of the Sassanian kings; Cuxana, where Xenophon and his 10,000 Greeks commenced their historic retreat through a land cut up by innumerable canals; and lastly Babylon, "The Gate of God," once captured after some smart hydraulic engineering by the Persian besiegers.

On one side of the Tigris the delta was formerly irrigated by the great Nahrwân Canal and an extensive system of smaller canals, and between the Tigris and the Euphrates the country was watered by main and branch canals running more or less parallel with the river, and by a vast network of canals extending from river to river. The lives and property of cultivators were secured on one hand by the Median Wall, and on the other by the towering bank of the Nahrwân Canal, these ramparts being guarded by soldiers to prevent the incursions of wandering tribes. The river Tigris, that silent witness of the rise and fall of Assyrian power, flows to-day past the ruins of Nineveh, and breaking through the Hamrin Hills, enters the high-lying plateau at their feet, and passes in a trough some 60 ft. deep over a shingly bed, the velocity of the stream being 7.5 ft. per second, and its average width 1,500 ft. Near Opis, the Atheim river flows into the Tigris, and at this point the delta is entered. The character of the river bed then changes, shingle giving way, first to argillaceous marls, and then to finer alluvium, both well suited for irrigation and agriculture. Below Bagdad the Dyâleh river joins the Tigris, and thenceforward the fine alluvial deposits of the delta, accompanied by salt, continue to the sea. The annual flood commences about the end of the winter season, and is augmented with the advance of spring and summer by the melting of snows in the hills, the supply of water increasing as temperature rises. Still, as the rainfall is generally insufficient for agriculture, uniform and adequate supplies cannot be ensured without irrigation works. That part of the country with which we are chiefly concerned is the delta of the Tigris, in which Opis is the natural starting point for a great system of irrigation. Above this place the engineers of a remote period established the intakes of their most important canals the Nahrwân on the eastern bank, the Ishaki and others on the western bank. In order to ensure the better supply of water to the canals, rubble weirs were formed across the Tigris downstream of the canal heads, very much as the Asyût barrage has been built below the head of the Ibrahimiyeh Canal on the Nile. Each of the great canals acted as the

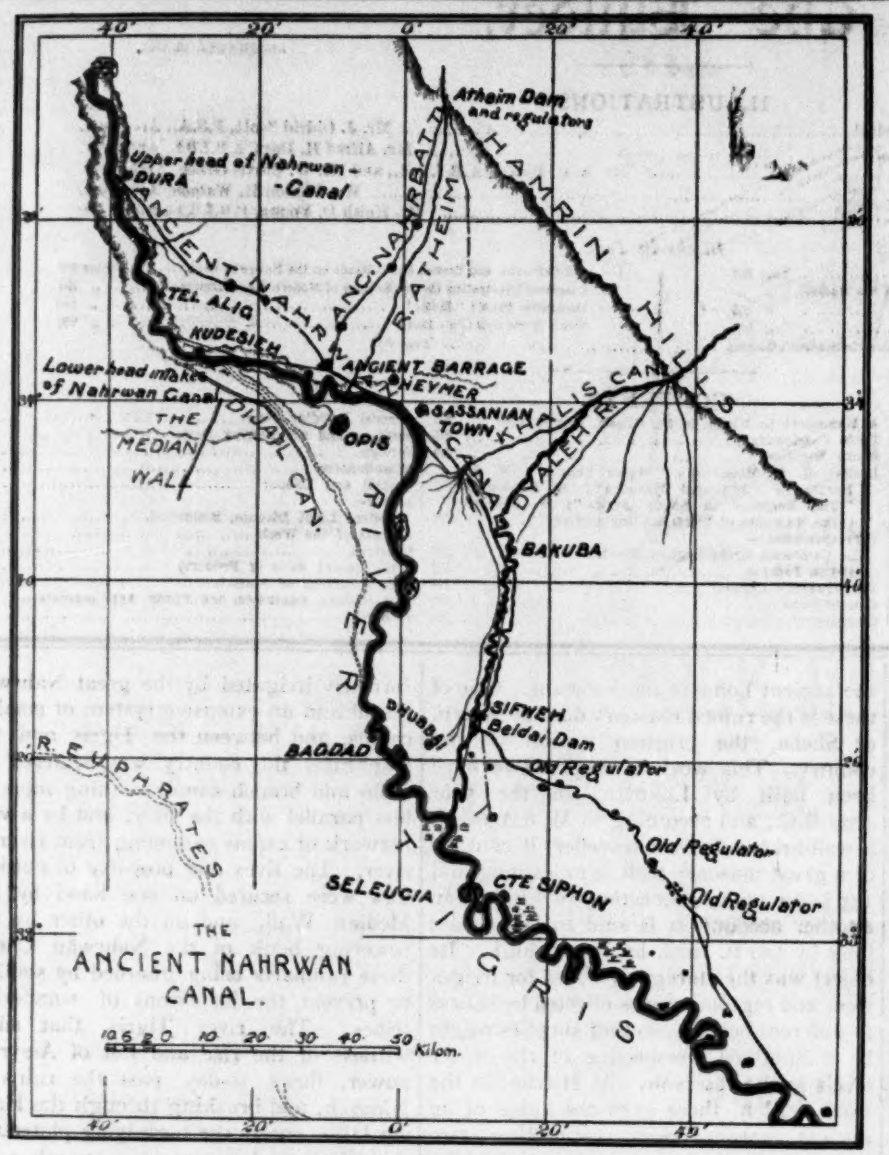

Fig. 1.—Map of the Ancient Nahrwân Canal.

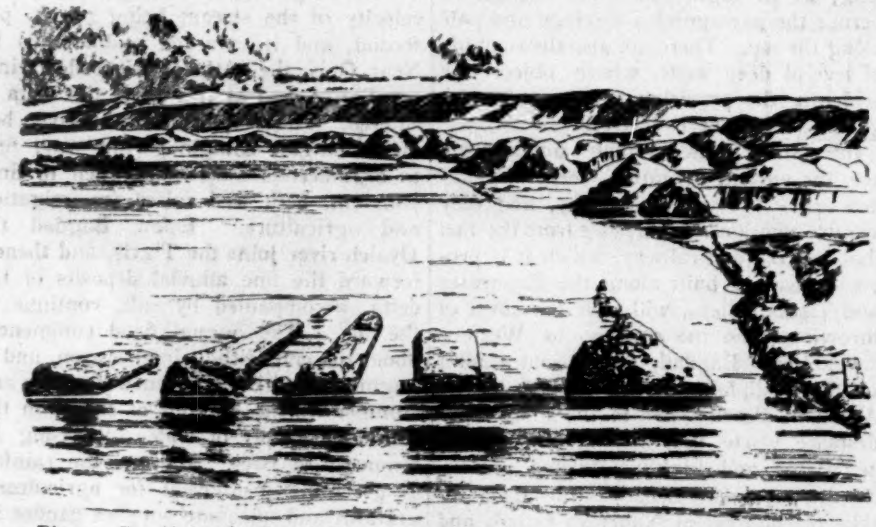

Fig. 2.—The Nahrwân Canal Regulator: Ruins now in the bed of the modern Tigris.

feeder for a huge system of smaller channels serving the country on either side of the river.

Reference to fig. 1 will tend to make more clear the following description, but it should be noted that when these canals were constructed, the Tigris flowed in its ancient bed, and Opis stood on the eastern bank. Reference will be made later to the transference of the river to its present course, an event that brought desolation to one of the most populous and fruitful countries in the whole world. The Nahrwân, known in its upper reaches as the Katul-el-Kesrawi, the "Trench of the Kaiser," originally served the purpose of supplying a large system of canals between Opis and a point some hundred miles below, where the main canal rejoined the Tigris. Like many canals that require silt clearances at intervals, the Nahrwân had two heads. The upper head, about 40 miles in length, took water from the Tigris just above Dura, where are the remains of the Kantara Resasa, a large masonry weir built of massive stones clamped with lead. The lower head at Kudesieh had two intakes, each 360 ft. wide, and a grand regulator, the ruins of which are now in the modern bed of the river. In fig. 2 we reproduce a sketch of these interesting remains, which have resisted the ceaseless flow of the river and the floods of countless centuries. At the junction of the canal heads once stood a flourishing city, and the massive barrage known as Kantaret-el-Kesrawia, the Bridge of the Kaiser, the remains of which still exist.

The total length of the Nahrwân Canal was about 250 miles. For the first few miles its channel was 65 ft. wide by nearly 50 ft. deep. It then attained an average width of nearly 400 ft., while the depth was reduced to about 36 ft. Below the Dyâleh river, which carried a large part of of the supplies, the canal was reduced in width to 130 ft., but when Sifweh was passed it again widened out to about 360 ft. It is interesting to compare the dimensions of this giant waterway with the largest of Egyptian canals—the Rayan el-Menufiyeh, of which the width is 174 ft., and the depth 20 ft. in flood, and 10 ft. in summer. Speaking last year of this canal, Sir Benjamin Baker said that even in the exceptionally dry time of June, 1900, it was carrying a volume of water one and a fourth times greater than the Thames in mean flood. Hence in flood time it would be quite capable of conveying two and a half times the quantity of water carried by the Thames. But the Nahrwân Canal had a section four times that of the Menufiyeh, and its maximum capacity was fully ten times that of the Thames in mean flood! Just below the confluence of its two main feeders, the Nahrwân Canal is severed by the Atheim river, and has disappeared for a length of more than a mile. In ancient times injury by this river was guarded against by some remarkably well-designed engineering works at the foot of the Hamrin Hills. A masonry dam, about 800 ft. long by 55 ft. high, was bullt across the river, connecting the spurs of two hills, and masonry regulators were provided at the same point. By these means the waters of the Atheim were divided between two canals, the Nahr Batt, and the Nahr Rathan, irrigating the country on either side of the river, and discharging into the Nahrwân through masonry regulators. The present course of the Nahr Batt may be seen in fig. 1. The Nahr Rathan has long since disappeared. The general design and construction of the Atheim Dam are sufficiently indicated by the plan and elevations reproduced in fig. 3. Below the ruins of Heyme, the Nahrwân has been totally destroyed for a distance of several miles by the diversion of the Tigris. In consequence of the injuries already described, other damage naturally followed. The tail waters of the Khalis Canal, being no longer swept along by a powerful current, filled the Nahrwân channel with silt, and it ultimately became cultivated land, through which passes the modern Khalis, serving a system of smaller channels. Between the ruins of Bakuba and Sifweh, the ancient course of the Nahrwân runs parallel with the Dyâleh river, but the canal itself has practically disappeared. Along this stretch the Nahrwân was formerly at such a level that it was able to deliver water to the higher lands below Sifweh, whereas the Dyâleh could only

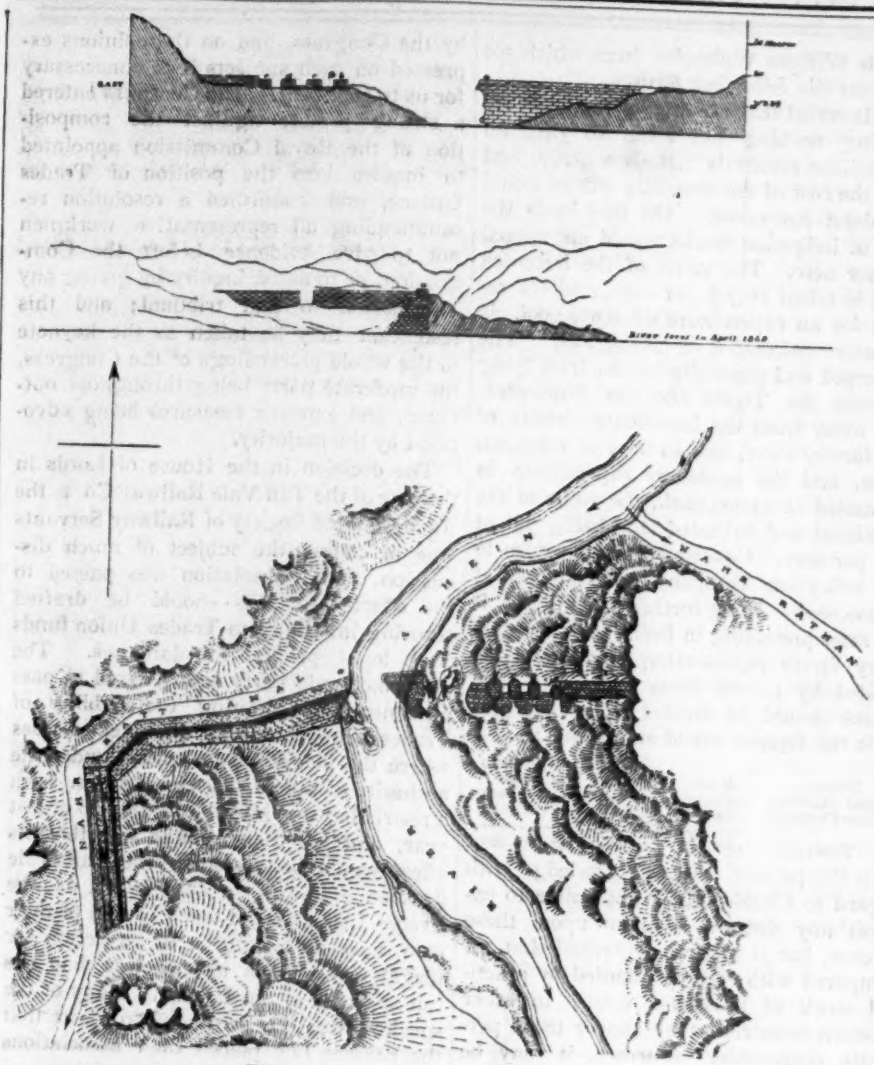

Fig. 3.—The Ruined Atheim River Dam.

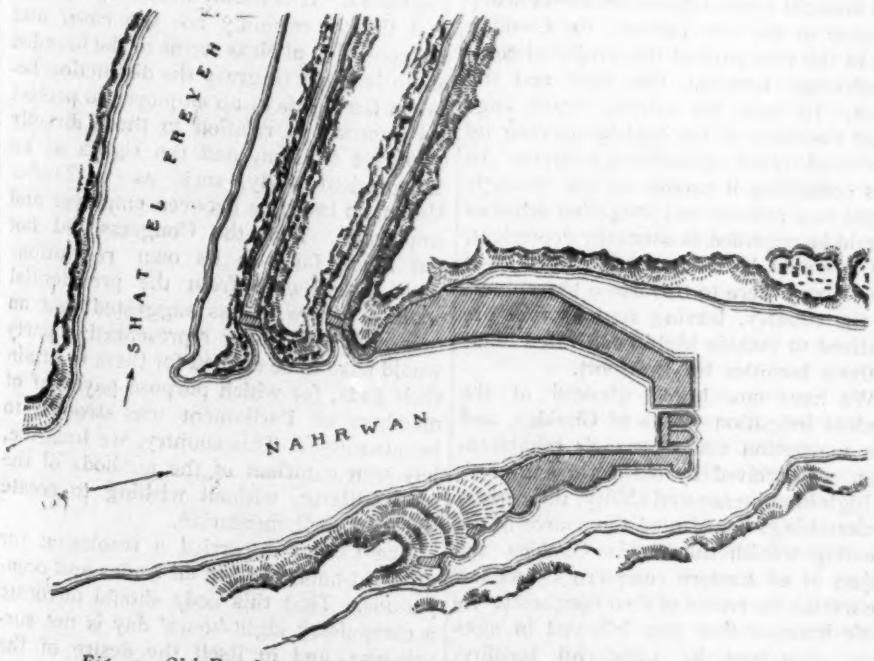

Fig. 4.—Old Regulator and Branch Canal Heads on the Nahrwân Canal.

serve the low-lying lands. Beyond Sifweh are the ruins of the Beldei Dam, once holding up the waters of the Dyâleh and delivering them into the Nahrwân, but in the present day the river effects a junction with the Tigris.

Between Beldei and the point at which the Nahrwân finally discharges into the Tigris there are numerous remains of ancient cities, main regulators, and branch canal heads, all testifying to the wonderful prosperity and civilisation that characterised this now deserted region. Fig. 4 is a plan showing an old regulator and branch canal heads in this reach of the Nahrwân. Even with the scanty materials available, it would be easy to paint a glowing picture of the ancient wealth and prosperity of Chaldea, but we prefer to turn to actual records. Accounts written nearly a thousand years ago described the Nahrwân Canal as "flowing amid continuous extensive villages, date-groves, and well-cultivated lands, and finally discharging into the Tigris a little below Badrai." It is further said, "It had well-constructed buildings on its banks, it flows amid cultivation and villages, and, in like manner, many branches emanating from it irrigate the country between it and the east bank of the Tigris. These copious branches reach unto the Tigris."

On the western bank of the Tigris were the Ishaki and Nahriyat canals, and a vast system of other and smaller channels irrigating the country above flood level, but of these watercourses few traces remain. Their ruin was compassed when the Tigris left its ancient bed, and since that event the modern Dijeil Canal was made, the term Dijeil being an old name of the Tigris, and its application to the canal system signified that the new waterways were intended to fulfil the duties of the departed river. But the "modern" Dijeil Canal is now an ancient work. The present state of a bridge over the Dijeil, at Harbeh, shows how the canal has withered away. The bed is choked with huge mounds of silt, and the little water that flows barely fills a single arch of the old bridge. This is typical of the whole country, where decay and desolation are everywhere apparent. Viewed from the high ground above Opis, the land presents an almost inconceivable picture of wreck. The dismembered walls of the great city lie at the feet of the beholder, while the mounds of many other cities and towns are dotted like islands over a vast plain, utterly bare of vegetation, and smooth as a calm sea. This aspect of the country clearly denotes bygone disaster, a sudden and overwhelming onslaught, prostrating everything in its way. Commander Felix Jones, in his interesting Memoirs, says that "The Tigris, as it anciently flowed, is seen to have left its channel and to have taken its present course through the most flourishing portion of the district, severing in its mad career the neck of the great Nahrwân artery, and spreading devastation over the whole district around. Towns, villages, and canals, men, animals, and cultivation, must thus have been engulfed in a moment, but the immediate loss was doubtless small compared with the misery and gloom that followed. The whole region, for a space of 400 kilometres, averaging about 30 kilometres in breadth, was dependent on the conduit for water, and contained a population so dense, if we may judge from the ruins and great works traversing it in its whole extent, that no spot in the globe perhaps could excel it. Of those who were spared to witness the sad effects of the disaster, thousands, perhaps millions, had to fly to the banks of the Tigris for the immediate preservation of life, as the region at once became a desert where before were animation and prosperity." These views as to the cause of the ruin that overtook Chaldea are confirmed by examination of the plans and levels of the country. When the main stream of the Tigris deserted its ancient bed, sweeping away the Nahrwân regulator, cutting out a new channel for itself, eating into one feeder canal, and finally biting away a huge slice of the Nahrwân itself, the ruin of that magnificent work and of all its dependent channels was complete and irreparable. Above Sifweh the canal was abandoned, and only

the lower reaches were thenceforward used. The dam at Beldei was strengthened, and a new head for the Nahrwân was constructed at the same place. Little benefit could follow the execution of these works, for the scanty supplies of the Dyâleh river were utterly inadequate, and no help was afforded from the plenitude of the Tigris. On the western bank the damage was little less disastrous. The old river bed silted up, the weirs that had held up the waters to feed the main canals no longer fulfilled their function, the canals dwindled away and the region became a desolate waste. As the ruin of the Nahrwân was the greatest blow the country has ever received, so its restoration would be the greatest blessing that could be bestowed.

A scheme for the restoration of the ancient irrigation works on the Tigris has recently been propounded by Sir William Willcocks in a lecture delivered at a meeting of the Khedivial Geographical Society, Cairo. The rehabilitation of Chaldea is a most interesting subject, and discussion is opportune at the present time in view of the attention that is being devoted to the Bagdad Railway scheme. With politics, Sir William Willcocks disclaims all connexion. His ambition is simply that of an irrigation engineer, "to see ten blades of grass growing where none are growing to-day." His lecture is addressed solely to the engineering and economic problems involved in the re-creation of Chaldea by the restoration of her ancient irrigation works. The first works recommended are the reopening of the ancient channel of the Tigris, and the construction of a weir at the head of each branch, so that both the ancient and the modern Tigris may be maintained and properly controlled, just as the branches of the Nile are maintained and controlled by the Cairo barrage. The Nahrwân Canal would be renewed and remodelled throughout, and provided with a new head. The treatment of the Atheim river would be of similar character to that already described, and it is significant that Sir William Willcocks, one of the most competent hydraulic engineers of the twentieth century, has no improvement to suggest upon the principle adopted by Chaldean engineers who flourished thousands of years ago. A new course is proposed, to carry the canal round the bend of the Tigris opposite Opis, and powerful spurs would prevent further encroachment by the river. A super-passage is proposed for the Khalis Canal to prevent interference with the Nahrwân; the Dyâleh river would serve the low-lying lands in the direction of Bagdad, while the higher lands would again be watered from the Nahrwân, flowing at a high level in a new channel traversing a new course. This chain of works could be executed within reasonable time, and although not covering everything necessary, would suffice as the basis upon which the complete system of irrigation could be rebuilt. To enable a precise estimate of cost to be made, information would necessarily have to be gathered by experts —such as could only be attained by months, and perhaps years, of patient observation and field work. By way of affording a general idea as to the financial success of a modern irrigation system, a preliminary estimate of costs and results was presented by Sir William Willcocks, from which we abstract the following figures.

It is stated that the area of the lands requiring nothing but water to yield an immediate return is 1,280,000 acres, and that the cost of the necessary works would be about 8,000,000*l.* On this basis the cost of irrigation works would not exceed 7*l.* per acre. The value of the irrigated land is taken at 30*l.* per acre, and the return for an expenditure of 8,000,000*l.* is therefore calculated at 38,400,000*l.* The swamped and generally barren tract lying between the Tigris and the Euphrates, and away from the immediate vicinity of the former river, has an area of 1,500,000 acres, and the necessary expenditure is estimated at 13,000,000*l.*, the value of the reclaimed and irrigated land being put at 15*l.* per acre. Consequently the return to an irrigation company is estimated at 22,000,000*l.* It is further stated that if the rates prevailing in India were adopted, every figure representing cost should be divided by 4, and those expressing land values should be divided by 2. On this basis the figures would stand thus :—

District.	Acres.	Cost of Works.	Value of Land.
Upper Chaldea..	1,280,000	£2,000,000	£19,000,000
Lower Chaldea..	1,500,000	3,250,000	11,000,000
Totals.....	2,780,000	£5,250,000	£30,000,000

In the present state of knowledge with regard to Chaldea, it is impossible to express any definite opinion upon these figures, but it may be remarked that, as compared with records afforded by practical work of a similar nature in other Eastern countries, they appear to be perfectly reasonable. Further, it may be observed that every acre of land reclaimed and brought under cultivation would bring revenue to the new railway, for Chaldea lies in the very path of this projected communication between the East and the West. In turn, the railway would augment the value of the land by opening up new markets for agricultural produce. In this connexion it cannot be too strongly urged that railway and irrigation schemes should be regarded as mutually dependent, for it would be a lamentable mistake if the railway were to traverse a barren part of the country, leaving regions that are destined to include highly cultivated lands without facilities for transport.

We have now briefly glanced at the ancient irrigation works of Chaldea, and the suggestion made for their rehabilitation. Conceived by old-world engineers of high intelligence and ability, these great undertakings constituted the source of the teeming wealth that made Chaldea the object of all Eastern conquerors, and her possession the crown of their conquests. As their inauguration was followed in ages long since past by wonderful fertility, flourishing population, and boundless wealth, so would their restoration be followed, re-creating the ancient glories of Chaldea, so that, as of old, men might journey from the East—and even from the West—to find a resting-place in the plain of Shinar.

THE TRADES UNION CONGRESS.

THE Trades Union Congress, in sittings extending over several days, has discussed a variety of subjects, many of which involve purely political questions which would appear outside the scope of debate by the Congress, and on the opinions expressed on such subjects it is unnecessary for us to comment. The Congress entered a strong protest against the composition of the Royal Commission appointed to inquire into the position of Trades Unions, and confirmed a resolution recommending all representative workmen not to give evidence before the Commission, or to assist inquiry by giving any information to that tribunal; and this resolution may be taken as the keynote to the whole proceedings of the Congress, the moderate party being throughout outvoted, and extreme measures being advocated by the majority.

The decision in the House of Lords in the case of the Taff Vale Railway Co. *v.* the Amalgamated Society of Railway Servants was of course the subject of much discussion, and a resolution was passed to the effect that Bills should be drafted securing immunity to Trades Union funds from legal process for damages. The more moderate party endeavoured to pass an amendment limiting the liability of Trades Union funds for damages to cases where the illegal act was done under the authority of the Trades Union rules. Such a restriction was inserted in the Bill of last year, and we then pointed out that its effect would be to render the Taff Vale decision practically a dead letter, as the Trades Unions could use a breach of their own rules as a defence to an action for illegal acts, which nevertheless had the full approval of the Unions. Many of the speakers had the hardihood to assert that the present law placed their associations in a worse position than associations of employers. It is hardly necessary to state that this is certainly not the case, and this confusion of ideas seems to be founded on an inability to grasp the distinction between the rights of an employer to protect his interests in relation to those directly employed by him, and the rights of an independent body, such as a Trades Union, to interfere between employer and employed. That the Congress did not put much faith in its own resolutions may be gathered from the presidential address, where it was suggested that an overwhelming labour representative party would have to be created for them to attain their ends, for which purpose payment of members of Parliament was strongly to be advocated. This country, we imagine, has seen sufficient of the methods of the paid agitator, without wishing to create the paid parliamentarian.

The Congress carried a resolution for an eight-hours' day in all trades and occupations. That this body should advocate a compulsory eight-hours' day is not surprising; and in itself the desire of the workmen only to work eight hours would be perfectly legitimate were they contented to receive eight hours' pay, but it is notorious that the individual members of the working classes are by no means anxious to forego the advantages of overtime, and strongly resent separate labour being used for overtime. So as it stands the resolution is one wholly impracticable. The trade of this country, with the stress of foreign competition every year more keenly felt, can certainly be placed under no artificial restrictions.

A Bill to amend the Workmen's Compensation Act was discussed, and referred

back for further consideration. We have frequently commented on Bills to amend this Act, and it is well-known that the Government intend at an early date to legislate further on this question. The Bill before the Congress has for its object the extension of the principle of workmen's compensation to all employments. It contains many clauses which we have before pointed out were either unworkable or unnecessary. Thus it seeks to render employers liable to pay compensation for injury "by accident or otherwise." "Otherwise" can only apply either to negligence on the part of the employer amounting to wilful injury, or to wilful misconduct on the part of the workmen; for an injury supervening on ordinary negligence is invariably an accident. The Bill further purposes that it shall be impossible for an employer to "set up contributory negligence or any other defence," but contributory negligence is no defence under the present Act. There is apparently a desire to set up a right to compensation according to the grade of employment, apart from the actual employment of a workman at the time that he sustains injury; but Clause 7 is entirely incomprehensible. It provides that in the case of a minor employee permanently disabled, "regard shall be had to the full wages earned by a workman in the highest grade of the same employment." There are other clauses rendered unnecessary by recent decisions, and it seems surprising that the interval which has elapsed since this subject was discussed by the Trades Unions had not sufficed to enable a more workable measure to be presented to the Congress.

Resolutions were passed with a view to facilitating housing of the people and cheap means of access to crowded centres, but a resolution setting up courts of compulsory arbitration was lost; it was, however, resolved to draft a Bill amending the Conciliation Act, whereby either disputant, or a public governing body, were to have the power to call for investigation into a dispute and to issue a report to the public. We had occasion recently to comment on the Return on Strikes and Lockouts, and the pleasing features it disclosed of a better understanding which seemed to be arrived at between employers and employed in the settlement of disputes; but public intervention would hardly seem likely to further this end.

NOTES.

Local Indebtedness. THE publication of the Local Taxation returns again furnishes an opportunity for calling attention to the serious question of local indebtedness. We showed at this time last year that the amount of the local indebtedness was equalling the amount of the National Debt, and the two classes of indebtedness may well be considered together. The National Debt is jealously watched, yet the burden of local indebtedness is allowed to be steadily increased almost without comment, although the increase in the rates which it necessitates is fully as burdensome as the national taxation, and falls, moreover, on classes which are exempt from taxation. The present Government will be more celebrated for its zeal in granting Committees of Inquiry than for its effective legislative action, and there can be little doubt that such inquiries are an excellent means of silencing inconvenient opposition and of shelving difficult questions. But it is time the public asserted its opinion that inquiry is not everything, and that the proper body to deal with matters of national importance is Parliament itself, and not various Select Committees. As an example, we may cite the Select Committee appointed to inquire into the subject of municipal trading. The country called decisively for an inquiry as to whether such a system was good for the nation in itself. This agitation was silenced by the appointment of a Select Committee of both Houses of Parliament, yet the Report of that Committee expressed no opinion on the merits of the system which has sprung up almost unheeded in our midst, but owing to the lack of time at its disposal confined itself to recommending a system of audit of the accounts; a recommendation which, if followed, would, we submit, only tend to sanction the principle of municipal trading by impressing upon it the seal of Parliamentary sanction, before the country has been satisfied that such a system is in the least desirable in itself. The returns now published show continued increase in the growth of local indebtedness, and we trust that agitation on this question will speedily be renewed.

The Victoria Falls Scheme. ONE of the largest engineering projects in the world is now under consideration by the African Concessions Syndicate. The details of the undertaking will not be settled until the site has been further surveyed, an operation for which the sum of 10,000*l.* has been allocated. The proposition to which we refer is the utilisation of Victoria Falls, in Rhodesia, a far greater scheme than the harnessing of Niagara Falls in the Western Hemisphere. The total height of the Niagara Falls is about 160 ft., whereas at the Victoria Falls the height is more than 400 ft. Again, while the total power running to waste at Niagara is estimated at 7,000,000 h.-p., the available power is put at 35,000,000 h.-p. Of course, it will not be possible to find a market for this enormous amount of energy for many years to come, but no one who has studied the resources of the country around the Falls can doubt that the project is one fraught with the most tremendous possibilities. The country within a considerable radius of the Falls is probably more richly endowed than any equal area of the world with minerals—and particularly with gold, copper, iron, and coal. Moreover, the country is fertile, well-watered, and possessed of an excellent climate. These conditions suggest a great increase of population, and the development of important manufacturing industries. The trunk railway is already within seventy miles of the Falls, and early next year it will probably be completed to that point. As electricity is now recognised as the most economical agency for traction, it is believed that the Rhodesian railways will afford an opening for the supply of large quantities of energy when the proposed works have been established. Various mining centres already established should also be responsible for a very considerable consumption, while the development of the iron, copper, and coal industries, together with the concurrent increase of miscellaneous manufacturing industries and the growth of cities and towns, will afford further scope for the absorption of power. A few years ago it was not possible to transmit power to any great distance, but in the present day long distance transmission lines are being worked in the United States by the aid of which energy is transmitted for distances of nearly 300 miles, and proposals have been seriously made to connect New York and Chicago with the Niagara power-station, the distances being 450 miles and 500 miles respectively. If a radius of 600 miles could be served from the proposed power-station at Victoria Falls, the whole of the goldfields of South Africa would be included in the area, and a large proportion of its railways. In other words, the area would comprise 1,500,000 square miles, including the whole of Rhodesia, Bechuanaland, and the Transvaal, as well as the greater part of Portuguese Mozambique, German South-West Africa, Portuguese West Africa, and the Congo State.

Breakdowns on the Central London Railway. TWO or three recent mishaps on the Central London Railway, although causing considerable inconvenience to passengers, have demonstrated the capacity of the officials for dealing with emergencies. The first accident occurred on Tuesday last week, near the Bank Station, and the second took place on Thursday evening in the same week at almost the same spot, during the shunting of a motor train. It appears that one of the cars jumped the points, and coming into contact with the live rail caused a slight explosion. Current between the Bank and the British Museum Stations was immediately cut off, and an emergency circuit was simultaneously connected, lighting up the tunnel and stations as far as the latter point. The stations in the section were closed for traffic and all bookings suspended. One train was on the line between the Bank and Post Office Stations, and this being brought to a standstill the passengers were informed of the reason, and, guided by the conductors, they walked along the whitewashed planks, provided at each side of the permanent way, to the Bank Station, where they were speedily raised to the surface. There was not the slightest disorder or panic, and ten minutes after the occurrence of the mishap the whole of the passengers had been transferred to the street above. In response to a telephone message, a breakdown gang was promptly despatched from Shepherd's Bush, and the obstruction was removed in time for the complete resumption of traffic on Friday. A second accident took place later in the some evening at the British Museum Station, where another car jumped the rails at the crossover, and was derailed. Although these minor mishaps afforded opportunities for the officials to show their preparedness for emergencies, they also appear to indicate that something is radically wrong with the design of the rail junctions at the crossover roads of the line, and it is to be hoped that this matter will receive careful attention from the responsible engineers.

Dover Harbour Works.

REPORTS in the daily Press relative to the damage caused at Dover by the recent storm appear, as usual in such cases, to have been considerably exaggerated. The suggestion that portions of the national harbour works had been swept away, involving a loss of some 70,000*l.*, rested on no substantial basis, and the fact is that no injury whatever occurred to the permanent work, the damage being confined to the destruction of one span of an isolated staging, belonging to the contractors. The loss, which is fully covered by insurance, is estimated at about 7,000*l.*, but no serious hindrance to the works is anticipated on this account. The staging was erected for temporary purposes in April last, on the site of the eastern entrance to the new harbour, and it is worthy of note that none of the contractors' plant on the easterly arm, or on the extension of the Admiralty Pier, has been in any way injured by the storm. Since the recent severe weather, careful examination of the permanent works has been made, with the result that not the slightest evidence of damage is forthcoming. This is satisfactory proof of the strength possessed by the new harbour walls.

The Motor Car Act.

THE letter recently published from an important firm of motor car manufacturers expressing strong approval of the Motor Car Act, as being calculated to further the interests of the trade, is instructive when compared with the outcry against this measure raised by the Automobile Club. It points the marked difference of opinion which exists between those who have the interests of this trade really at heart, and those who merely use the argument of its importance in order to secure their own ends. If those persons who use the cars, and whose opinions have so freely been voiced by the Automobile Club, had shown the same spirit which is now displayed by the manufacturers, motor cars would never have incurred the odium which now attaches to them; but the motorists, while loudly condemning the "road hog" in words, by their attitude towards this Act have conclusively proved that they object to any legislative hindrance to his proceedings; and the public have naturally drawn the deduction that in consequence they are as a body anxious to emulate his example. We congratulate the manufacturers on their commonsense, and trust that their customers will profit by the lesson thus taught them,

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Electrical Fire Insurance Rules.

WE have received from the Liverpool, and London, and Globe Insurance Company, and also from the Royal Insurance Company, copies of their electrical installation rules. In both cases we are glad to see that the general rules are practically identical with those issued by the Institution of Electrical Engineers a few months ago. It is unnecessary therefore to criticise them, as we should merely have to re-state those points where we think the latter could be improved. Both insurance companies also give a "special risk" supplement, which gives some hints which will be useful to contractors and consulting engineers. The rules in a few cases are very awkwardly expressed, and they could easily be made much plainer. We are told, for example, on page 46 that wires "should not be arranged in a vertical plane one over the other, as sparking contacts between the two are then more likely to occur." We suppose this means that accidental short circuits are more likely to occur when the positive and negative wires are in a vertical plane than when they are in a horizontal plane. Great stress is laid in both sets of rules on the value of an earth leakage detector of a very primitive nature. It seems to us, however, that this device can only be used in a few very special cases, and that even in these cases an indicator which rang a bell would be preferable to a device which merely showed one lamp burning brighter than another, and that only in the case when one main remained sound. If both mains were equally bad no indication would be given that anything was wrong.

Evaporation of Metals.

SOME interesting results recently obtained by means of the electric furnace afford further information as to the behaviour of various metals under the influence of heat. In the experiments to which we refer, the fact that many substances boil quite regularly, and at a definite temperature, under the pressure of a column of their own vapour in the vacuum of the cathode light, was applied to various metals. The metals selected were placed in quartz vessels, tight joints being made with wax to maintain the cathode light vacuum, and the required temperature was furnished by an electric furnace. The latter appliance is not only convenient for the exact regulation of temperature, but it is essential for such operations, for it is necessary that the wax joint should not be melted, as would occur if any other type of furnace were employed. During the course of the investigation it was found that in the vacuum of the cathode light zinc sublimed rapidly even at 300 deg. C., actual boiling occurring when the temperature outside the tube was about 640 deg. C., and the rapidity of the process may be gathered from the fact that five grammes of the metal were distilled in about thirty minutes. Lead commenced to evaporate at about 1,000 deg. C., and boiled vigorously at 1,180 deg. C. Tin appeared to be much less volatile, showing no sign of evaporation at 1,100 deg. C. Copper evaporated at 1,300 deg. C., but the exact point of boiling was not ascertained, as the temperature of the furnace did not extend beyond 1,400 deg. C The other metals included in the experiments were cadmium, selenium, tellurium, antimony, bismuth, silver, and gold. It appears that cadmium sublimes at 322 deg. C., and boils when the temperature of the oven is 474 deg. C. Selenium distils rapidly at 380 deg. C.; tellurium sublimes at 430 deg. C., boiling at 555 deg. C.; antimony evaporates at 670 deg. C., and distils with some rapidity between 775 deg. and 780 deg. C. Bismuth evaporates at 540 deg. C., and boils at 1,045-1,050 deg. C. Silver evaporates rapidly near its boiling point, but at the temperature of 1,340 deg. C. gives no evidence of boiling. The actual temperatures at which metals boil depends upon the temperature of the oven, as well as upon the height of the vapour column, and it is worthy of note that the boiling points are in the order of the valencies, and not of the atomic weights of the metals.

Natural Magnetic Water.

MOST people are somewhat sceptical as to the accuracy of reports relative to naturally magnetic waters, but it appears from an article in the *Engineering News*, by Mr. Leighton, hydrographer to the U.S. Geological Survey, that there are three waters in the State of Indiana which actually impart magnetic powers to needles, knife blades, and other steel articles immersed therein. One is at Cartersbury Springs, another is derived from a well at Lebanon, and the third is from a well at Fort Wayne. All these waters contain large proportions of carbon dioxide, which is slowly released on exposure to the air. So long as the water retains this gas it appears to impart magnetic properties to steel, but as soon as the gas has escaped a precipitate of magnetic oxide of iron forms at the bottom of the containing vessel. Experiments made at Cartersbury Springs showed that after a knife had been immersed for a period of five minutes needles were readily held edge to point, while two needles immersed for two minutes were mutually attached by the points, and held for four minutes in the face of a strong breeze. The knife in question is said to have retained its magnetic properties for about thirty hours. The well at Lebanon was driven for the purpose of feeding locomotive boilers on the Big Four Railroad, and it was found to be the most corrosive water along the whole line of railway. Examinations by Dr. Hurty, chemist to the company, made evident the existence of strongly developed magnetic properties, and suggested the remedy of injecting steam into the water tank for the purpose of precipitating the magnetic oxide. Water from the well at Fort Wayne is said to be even more strongly magnetic than the other waters mentioned.

Concrete Steel in Dam Construction.

STEEL diaphragms have already been employed in substitution for puddle walls in the construction of earth dams, and the proposal is now made in the United States to adopt a concrete-steel facing for a rock-fill dam. This does not appear to be a method by which the properties of concrete-steel can be most advantageously utilised. The proper place for such material is certainly in the centre of the section, where it might be invaluable as an efficient barrier to the passage of water through a dam of masonry or of earth. The concrete-steel diaphragm should be built up vertically in the centre of the dam in the form of a wall from 4 in. to 6 in. thick, and firmly anchored in cement masonry at the foundation as well as at the abutments. If properly designed and constructed, a core diaphragm of this character would be impermeable, tough, and flexible, and should give excellent results.

The Steam Pile-Driver.

WHEN the principle of the steam hammer was first applied to pile-driving, predictions were freely made that the last days of the rope-hoisted "monkey" were approaching. The steam pile-driver is undoubtedly a most efficient machine, but

as a matter of fact in ordinary pile-driving operations a comparatively small portion of the time spent by the workmen is devoted to actual driving. For instance, the piles have to be got into the leaders, straightening up and bracing have to be done, as well as levelling and nailing on guides for sawing, sawing off, and sundry minor operations. Under such circumstances it may easily happen that only a few minutes in every hour are occupied in driving the piles. The need of the present day is less for improved driving-machinery than for improved methods of preparing work for the pile-driver. In some cases, no doubt, considerable advantage may be derived from the use of the steam-hammer principle, but for every-day work the ordinary old-fashioned apparatus appears likely to hold its own.

Welsh School Boards and Architects.

SOME time since we commented on the action of the Abergavenny School Board in advertising for an architect and requesting architects to "state their terms." Another Welsh School Board, that of Blaenavon, has followed suit, having advertised for an architect to prepare plans, advise, and superintend the erection of a school proposed to be built in the town of Blaenavon, applicants to reply "stating terms and qualifications." The natural result of this appears in the report of the appointment of the architect. We regret to find that twenty-eight architects had sufficient lack of professional dignity to reply to this kind of advertisement, and we read that one of them, "whose price of 3 per cent. was the lowest," was appointed. Anything more degrading to the profession of architecture, both on the part of those who advertised and those who replied, can hardly be imagined. No Board would dare to treat the legal or medical profession in that way; that they will presume to do it with architects is due to the want of self-respect and *esprit de corps* on the part of some members of the profession.

Great College-street, S.W., and the Westminster Improvements.

As a part of the scheme for local improvements, the Ecclesiastical Commissioners, as owners of the freeholds, have taken for their own purposes so much of the land as is bounded by Great College-street (north), Wood-street (south), Little College-street (west), and Millbank (east). Subject to the widening of Great and Little College streets the site we indicate is appropriated for the Commissioners' new offices, with suites of other offices and chambers, for which Mr. W. D. Caröe, architect to the Commissioners, will make the plans and designs. The demolition of property in the immediate vicinity is being proceeded with. The houses in Millbank between Romney-street and Horseferry-road are gradually being pulled down, and a further clearance is made at the western end of Great College-street by the demolition of Nos. 21-28, between Barton and Tufton streets, where, we hear, will be erected a settlement-house for the Cowley Fathers; another site has been allotted for new offices of the Lancashire and Yorkshire Railway Company. Thus an old-world street of singular charm and interest will be quite transformed. Black Dog-alley, leading into Tufton, formerly Bowling, street, marked the site of the garden of Abbot Benson, who became first Dean. Along the north side of the street, once known as Dead Wall, stands the wall as rebuilt by Abbot Litlington (1362-84), of the Infirmary, since the College, Garden. The street itself follows the course of the Mill Ditch, an effluent of the Aye Brook, that drove the Abbots' Mill standing at what is now the corner by Millbank. Little College-street was in 1720 Piper's Green, and was built, together with Barton, Cowley, and Wood streets, in the latter years of George I.'s reign. Barton Booth, the actor, built Barton-street, and Cowley-street commemorates his country seat at Cowley, in Middlesex. Wood-street, the home of John Carter, the "Antiquary" of the *Gentleman's Magazine*, was built in 1720. North-street, where lived Elliston, the actor, is coeval in date, and presents a very pleasing vista towards Archer's Church of St. John. Many of the houses retain their fine old iron-work and interior decoration and panelling. Though somewhat fallen from their once high estate, the streets constitute a very uncommon group of what might be called the Mayfair of that part of the town.

The Cope Bequest, South Kensington Museum.

AN addition has recently been made to the Oriental Collection of the Victoria and Albert Museum by the bequest of the late Mr. W. H. Cope. The cases containing the new exhibits are five in number, situate in the Cross Gallery adjoining the Indian section. The first case contains marvellous carvings in jade, crystal, and other stones from China and India; a bowl and a teapot cut out of crystal inlaid with gold wire-like ornament, forming a setting for rubies, emeralds, and diamonds; some turned and carved dark green; jade candlesticks from India; two agate cups; a beautiful carving in lapis lazuli, and a rosary of wood jade, gold, pearls, and crystals are some of the most valuable and interesting specimens. In the second case is a miscellaneous collection of Chinese enamels of great beauty both in colour and in simplicity of shape, some plain but excellent lacquer work, and some very ugly Japanese netsukes. The third case is devoted to glass of various dates and from various countries, amongst them some tall Venetian glasses with stems of marvellous and fantastic shapes, which Mr. Cope acquired at the Magniac sale. The remaining cases contain examples of Chinese porcelain; in one some rather ugly but very rare vases—hitherto not represented in the Museum—of splashed glazes; wine pots in mythical forms, bottles and jars of shapes and colours indescribable; in the other a considerable collection of egg-shell cups and saucers and plates of the Chien-lung period (1736-1795) of daintiest colours, showing painted flowers, figures, and animals. This case shows the greatest care and judgment in the choice of the specimens. Such a collection of porcelain as this speaks better than words of the wonderful art of the East, the art which is even now decaying, probably from the unnatural demand made by foreigners upon the sources of supply. Such art is beyond imitation, it is the piled-up tradition of centuries and of generations of the most skilful craftsmen the world has probably ever produced.

Whistler and the Royal Academy.

THE correspondence of contradictions which has been going on in the *Times* as to whether the late Mr. Whistler might, could, would, or should ever have consented to become a member of the Royal Academy, has been clenched by a letter to Mr. Harry Quilter from an artist (name not given) who was with Whistler and a Royal Academician (whose name is also withheld) at the Arts Club one evening, when the R.A. asked Whistler point-blank if he should propose him as an Associate, and Whistler "consented somewhat eagerly, and did not let the point drop." This plain statement, which no one has ventured to question, is an amusing commentary on the assertions of the Whistler clique to the effect that their idol would never have condescended under any circumstances to become a member of the Academy.

The Promenade Concerts, Queen's Hall.

THE managers of Queen's Hall have paid us the compliment of assuming that we are interested in all forms of art, by sending us a season invitation to the Promenade Concerts now going on every evening at the Hall. An architectural journal, of course, deals really with the arts of visible form and line, and we cannot go so far beyond that field as to include musical criticism in our scheme, though the present Editor has been largely concerned with that subject in other pages. But we are very glad to take the opportunity of calling attention to the musical interest and importance of these concerts, where the public can hear, at an almost nominal price, finer orchestral playing than is to be heard at any other set of concerts in London, the constant relations between the same conductor and the same players leading to that complete mutual understanding which is necessary to the most perfect execution by a large phalanx of players. The progress in public musical taste of late years, in London at all events, is strikingly illustrated by these concerts. When promenade concerts were first started in England the programmes were almost entirely of the lighter kind of music, and a bit of classical music was only admitted now and then as an experiment. Now we find the greatest orchestral works of the great composers listened to with devout attention by an audience content to stand quietly throughout a long symphony, the liberty to "promenade" being practically abandoned. Mr. Wood is also making this an opportunity for introducing new works by English composers—a feature of great interest, although we may think that some of them are rather trying to express something than having anything really to express. The contrast with the works of the great masters is instructive in the matter of balance of form, design, and detail; for music is also design as well as expression. The characteristic of the most perfect musical composition—as for instance Beethoven's Concerto in E flat—is perfect form, finish in all the details, and nothing introduced which has not a definite relation to the whole design; a principle equally applicable to all forms of

art. As to such pieces of musical grotesque as Strauss's "Till Eulenspiegel," where the whole resources of the orchestra are used to produce an elaborate joke, one can only apply to them the question in Mr. Rudyard Kipling's poem—

"It's clever—but is it Art?"

ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS.

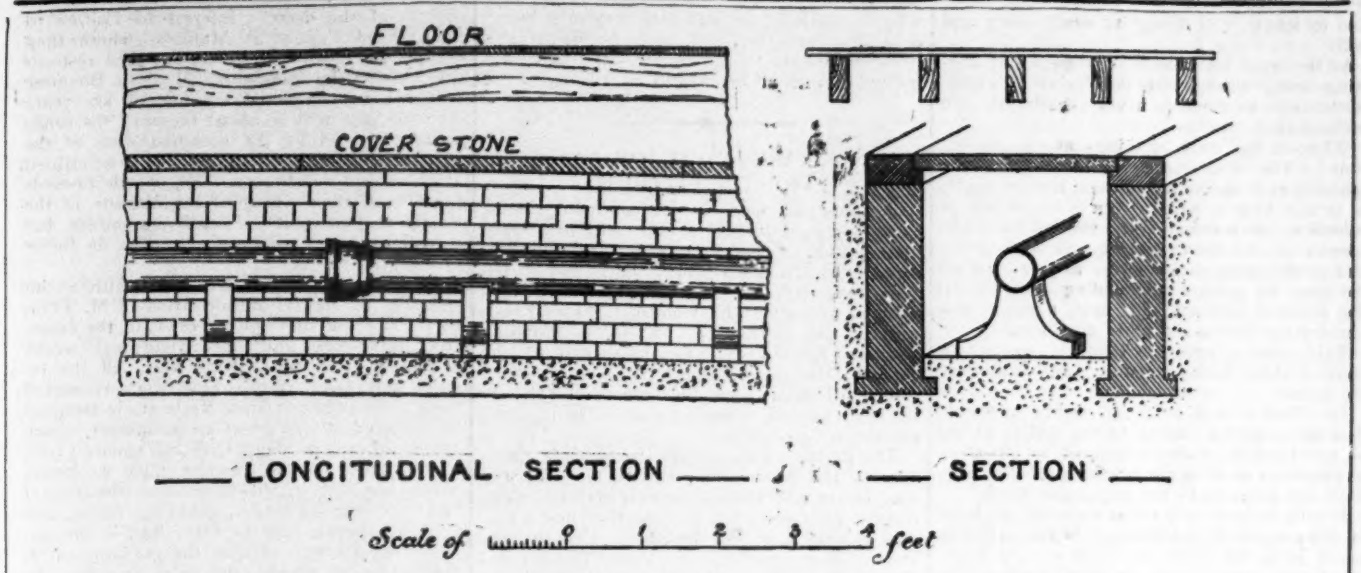
A HOME Counties District Meeting of the members of the Association of Municipal and County Engineers was held at Hastings on Friday and Saturday, September 11 and 12. The members assembled at the Town Hall, where they were received and welcomed by the Mayor and members of the Corporation. Mr. W. Weaver, C.E., of Kensington, President, was in the chair, and among those present were Messrs. A. T. Davis, Shrewsbury (Vice-President); Norman Scorgie, Hackney; P. H. Palmer, Hastings; R. J. Thomas, Aylesbury; A. D. Greatorex, West Bromwich; W. Harpur, Cardiff; C. H. Cooper, Wimbledon; T. G. Taylor, Ramsgate; P. G. Killick, Finsbury; E. Willis, Willesden; C. C. Smith, Sutton; J. Parker, London; T. Walker, Croydon; W. L. Bradley, Tonbridge; and others.

The Mayor of Hastings heartily welcomed the members of the Association, and thought after they had seen the engineering works of the town they would agree that Hastings was not altogether wanting in the carrying out of works necessary, for a town of some 70,000 inhabitants. Unfortunately, they would have an object-lesson of another kind, and one which probably many of them had not to contend with. He referred to the results of the previous night's gale. The gale was one of the worst experienced for twenty or twenty-five years, and it had done a certain amount of damage which looked on the face of it rather severe, for it had left their beautiful parades in a somewhat dilapidated state.

The President, in acknowledging the Mayoral reception, said he only came down that morning, but driving through the town he noticed that the wind had left its mark on some portions of it. Of course, it was a drawback to a seaside place that sometimes the healthful breezes, which gave a charm to a place, blew a little too strongly. But it did not often occur in the neighbourhood of Hastings, which was noted rather for its bright sunshine and equable temperature.

On the proposition of Mr. W. L. Bradley, Tonbridge, Mr. R. J. Thomas, of Aylesbury, County Surveyor for Bucks, was re-elected honorary secretary for the Home Counties district.

Mr. P. H. Palmer, M.Inst.C.E., Borough Engineer, Hastings, read a paper on the water supply of Hastings. He said Hastings was perhaps situated for the purpose of obtaining water within a few miles of the town as badly as any town in the kingdom. The district round Hastings was known under the general geological name of the Wealden. When considering these formations in regard to their capacity for yielding water supplies on a large scale, it must be borne in mind that they were not solid masses of great thickness, like the chalk or the new red sandstone, but were alternating beds of pervious and impervious materials in which the water was as a rule confined to the particular bed by which it was imbibed at the outcrop, the exceptions being the rare cases where an up or down throw fault might bring a higher and lower pervious bed together. Where the dislocations brought a pervious against an impervious bed no circulation of water could occur, and it was due to these circumstances, and the fact that the Hastings beds were so often broken up by dislocations of the strata, and interrupted by the presence of anticlinal and synclinal folds, that it was difficult and uncertain to obtain a very large quantity of water at one particular spot. The Borough has an area of 4,857 acres, and its population at the last census was 67,000; during the summer months this population was increased by visitors to upwards of 90,000. Years ago, and up to within the last ten years, the water supply was derived from surface-water reservoirs, situated in the Old Roar Valley, which was the centre valley running through the town, and Ecclesbourne Valley to the eastward; but owing to their proximity to the town, and the fact that the area immediately adjoining the reservoirs was highly cultivated, these sources were abandoned. These and several other smaller surface-water reservoirs were now kept entirely for the supply of water for street-watering and sewer-flushing purposes. About twenty-four years ago, owing to the difficulty in obtaining fresh water, the Corporation installed a separate system of pumping plant reservoirs and mains, for the distribution of salt water for street watering and sewer flushing; and when the surface-water reservoirs before alluded to were thrown out of use for drinking-water purposes, the use of salt water was discontinued, and fresh water from these reservoirs pumped through the mains. The plant in connexion with this supply was situated at Rock-a-Nore, at the east end of the town, and adjoining the refuse-destructor works. The pumps were entirely driven by steam generated at the destructor works, and had been from the time the destructor was erected fourteen years ago, and was one of the first instances in this country where power from a destructor was put to a useful purpose in connexion with municipal undertakings. The mains in connexion with the street-watering supply were principally 4 in. and 6 in.; they were however, considerably corroded through the action of the salt water, and in some cases were somewhat leaky. The Hastings Corporation were, he believed, the first Corporation in the kingdom to adopt the use of sea water for municipal purposes; they were also the first to discontinue its use. Some time ago the author made investigations in connexion with the use of sea water, and it was found unquestionably that it went much further than fresh water, and was very beneficial in damping down the dust in macadam roads; it was, however, found that people using carriages strongly objected to it on account of the fact that it damped the varnish. Greengrocers and others who exposed goods to view in their shops objected on account of damage done to their wares by the dust containing salt. It was also found that when a road had been watered for a fortnight or three weeks that it was necessary to thoroughly wash and broom the roads to get off the coat of salt; a week or so of watering with salt water had the effect of leaving a thin coating of salt on the road, and as soon as a damp day came (not rain, but moisture from the sea in the shape of sea fogs), the surface of the road used to be picked up by the wheels of vehicles in a very unsatisfactory manner. It was also found that the corrosion and the wear and tear of the machinery and mains was very great. From time to time the Corporation had taken steps to improve their water supply, and as far back as 1875 they obtained the advice of the late Mr. W. Topley, of the Geological Survey, as to establishing further works. In due course the Corporation put down wells, which were sunk to a depth of about 120 ft. in the Old Roar Valley, a few hundred yards south of the existing reservoir. The yield resulting from these wells and headings amounted to about 250,000 gallons in twenty-four hours. About the same time they took over the private works belonging to Mr. Burton, from which the supply to St. Leonards was obtained; St. Leonards at the time being a distinct and separate authority. The additions to the water supply sufficed for the time being, but again in 1882 the requirements due to the growth of the town necessitated an increased supply of water. Mr. Edward Easton was consulted, and following upon his recommendations wells and headings were sunk and driven at Filsham, at the extreme west end of the borough. The yield from this source was at first over 500,000 gallons per twenty-four hours, but the test pumping was not, in the author's opinion, sufficiently drastic. In due course the Corporation were advised to erect a large pumping station. This station was erected, and the plant put to work in the year 1885. The results, however, had been disappointing, as the yield had gradually fallen off, until at the present time it was not more than 250,000 gallons in the twenty-four hours. In the year 1892 it became evident that a further supply of water would have to be obtained for the town, and the author reported to the Corporation on several occasions as to the suitability of various sites and the amount of water which should be obtained to give the town a constant supply. After making searches in the neighbourhood within ten or twelve miles of the town, the author advised the Corporation to put various boreholes to the valley of the Brede, lying about eight miles north of Hastings. There were several good springs in the district, some of them yielding as much as 40,000 gallons in twenty-four hours; and after gauging the small River Brede and its tributary, the Forge stream, it was apparent that there was a considerable amount of spring water which found its way into the bed of these two small streams. The prospecting operations consisted of the putting down of five or six boreholes to various depths, and the sinking of two pilot wells. The results obtained from some of them were very satisfactory and from others poor; those obtained, however, from the pilot well at Redlay farm, and the one known as No. 6, close to the junction of the Forge stream valley with the Brede valley, were very good; the former after ten months' test pumping yielding close on 250,000 gallons in twenty-four hours, and the latter after several months of test pumping yielding upwards of 230,000 gallons. The yield from No. 4 borehole was also tested for the same period, and gave a yield of about 260,000 gallons in twenty-four hours. The results of the test pumping were so far satisfactory that the Corporation decided to commence permanent works in the Brede Valley. Negotiations with the landowners, however, having failed through their decision not to accept any other settlement than a royalty on the amount of water raised, the Corporation were fortunate enough to be able to secure a farm in the valley, having its longest frontage bordering upon the River Brede itself. In due course plans were prepared, and approved by the Local Government Board, for a permanent scheme of water supply, and in the autumn of 1899 the sinking of the permanent wells was commenced. The two wells had been sunk on the northern side of the valley to a depth of 270 ft.; and the well on the southern side to a depth of 210 ft. The wells were each 9 ft. in diameter, and lined with cast-iron tubing for a depth of 60 ft. below ground surface; below that point to the bottom they were lined with 9 in. of brickwork built in Portland cement. Behind the brickwork was filled in with clean rubble, and proper apertures were left at various points to allow the water to enter the well. The two pumping wells were connected 10 ft. above the bottom by a heading 6 ft. high and 4 ft. in width. The sinking of the wells was very slow and tedious work, the stratum excavated being of a very treacherous nature, full of water. A very large quantity of water was met with in the No. 2 well, and on several occasions weeks elapsed before the well could be pumped out to allow the sinkers to resume work. The wells and headings had taken nearly four years to complete, and owing to the length of time which the work had taken, it had been necessary to erect a temporary pumping-station at the No. 4 borehole to pump as much water as could be obtained for the supply of the town. Compressed air rock drills were used wherever possible in the boring of the headings, and electric light was installed throughout the works. The water from the Brede works would be pumped through a 16-in. main nearly six miles in length, to two circular covered service reservoirs immediately to the north of the town, and situated at an altitude of 510 ft. above O.D. The covered service reservoirs were each 150 ft. in diameter and 12 ft. in depth, each holding 1,500,000 gallons. They are built of concrete lined with blue Staffordshire bricks, and covered over with concrete. Owing to the two years' very serious drought which Hastings and the district suffered from a few years ago, the work of laying the main and constructing the reservoirs was pushed on as speedily as possible, and a temporary station put up at the No. 4 borehole adjoining the Brede works, and water pumped from there to the town. Although the permanent works would not be finished for probably another twelve months, the town had been receiving for over two years about 350,000 gallons a day from the temporary station at the No. 4 borehole, pumped through the permanent main and into the Fairlight reservoirs. The machinery which was being supplied for the pumping station consisted of two sets of pumps and engines, each capable of delivering 90,000 gallons of water per hour from the well, and discharging the same into an aerating chamber at a height of 20 ft. above the engine-house floor, and the rams capable of delivering 80,000 gallons per hour to a total vertical height of 515 ft. through a 16-in. main. The engines were triple expansion surface-condensing, having a high pressure cylinder 23½ in. diameter, intermediate 30 in. diameter, and low



pressure 62 in. diameter, with a stroke of 48 in. The machinery was being made by Tangye's, Limited, of Birmingham, and was practically completed and ready for delivery. Owing to the presence in the water obtained of oxide of iron, both in solution and suspension, the well pumps would deliver into an aerating chamber, 36 ft. in diameter through a trumpet-mouthed pipe, with a second overfall basin. The water from the aerating chamber would flow over a gauge into a valve chamber and would be filtered through four polarite filters, working under a head of 12 ft. Cottages for two workmen had been erected near Brede Bridge, and a house for the engineer in charge of the machinery would be built on the site adjoining the pumping-station. The quality of the water derived from the wells and headings at Brede was everything that could be desired. The quantity of water which could be obtained from the works already undertaken would be ample for the present requirements of the town, and every provision had been made for future extension, which would consist of additional length of headings. The total cost of the works would reach about 125,000*l.*, and in addition to this the amount spent in prospecting and testing the district, rent, and compensation, before the permanent works were undertaken, amounted to close on 20,000*l.* Before closing the author would like to mention that no doubt the particularly low death-rate of Hastings (which does not exceed fourteen per thousand of the population), and the almost total absence of typhoid fever, was due to the purity of the water supplied to the consumers, and the care taken in adequately flushing the sewers of the town. Hastings could certainly boast of being the sunniest town in the kingdom; last year the amount of sunshine recorded was 1,761 hours against 1,734 at Falmouth (which place was recorded as the next highest); the sunshine for London last year was 1,240 hours. In 1901 the amount of sunshine recorded at Hastings was 2,061 as compared with 1,394 recorded at London, and 1,896 hours at Brighton.

Mr. P. H. Palmer, M.Inst.C.E., read a paper on "East Hill Water-Balance Passenger Lift." He said the construction of the lift, although not involving a very large outlay—the total cost being under 6,000*l.*—involved considerable niceties in the matter of engineering. It was, of course, necessary that the proper inclination should be obtained in order to get the proper pitch on the cross-over drums and the arrangement generally of the machinery. The lift was not of a type frequently met with, but there were others of somewhat similar construction in the country, viz. at Folkestone and Lynton, but the angle of either was not so acute as in the case of this one. The work was designed and carried out by him, the details of the machinery were worked out and supplied by Messrs. Easton and Co., of Erith, and the two stations erected by contract. The stations were fitted with electric-bell communication, and communicators for indicating to the man in charge of the machinery the number of passengers in the ascending car; and the two stations were also in telephonic communication. The lift was opened for general traffic on April 9 last; 73,131 persons had been carried up to the end of August, and the amount received in tolls had been 307*l.* 9s. 1d. The Corporation were working the lift with their own staff. The working expenses were comparatively small, averaging about 4*l.* 10s. per week, and on no single week since it had been open had the receipts fallen below the expenditure. A loan was obtained under the Act of Parliament for its construction, the repayment of which would be spread over a period of twenty-five years. That the lift had been greatly appreciated by the general public and visitors, and was required, was clearly shown by the number of passengers carried, and no doubt during the winter months it would be considerably used by persons desirous of getting on to the hill to take part in or to view football matches, and in ordinary dry weather to obtain the bracing and delightful air which was to be got on the summit. It was estimated that there would be a surplus of about 300*l.* per annum after paying working expenses, interest, and sinking fund; and on a small undertaking of this kind it could be said to be a successful municipal undertaking.

The President said the papers were principally of a descriptive character. Possibly they might lead to criticisms as to what might be done under difficult circumstances in different places, and so on, but unless the members had some idea of the locality and the difficulties to be encountered, the criticisms could only be of a tentative character.

Mr. E. P. Hooley, Nottingham, proposed a vote of thanks to Mr. Palmer for his excellent paper.

Mr. H. Card, Lewes, who seconded, said he knew the difficulties which had attended the water scheme from 1892. He thought no one could have any idea of the difficulties that had to be encountered in experimenting in that valley.

Mr. Dickenson, Long Crendon, said he would like to congratulate Mr. Palmer on the condition of his macadam roads.

Mr. Brown, Southall, was sorry to see that the order for pipes went to an American firm, because he thought English manufacturers would have been able to supply pipes at an equally low rate.

Mr. Norris, Godalming, remarked that the conditions with which he had to deal, so far as water was concerned, were somewhat similar. With regard to foreign pipes on several occasions when he had had to lay mains the French pipes had been offered at a less cost than the English pipes.

The President, in submitting the votes of thanks, said he thoroughly endorsed it.

The vote of thanks having been passed, Mr. Palmer replied to the various questions raised.

On Friday Mr. Palmer entertained the members to luncheon at the Albany Hotel, and on the afternoons of both days visits were paid to the Brede Waterworks, in course of construction, the destructor, the water-balance lift, and other municipal engineering works in the borough.

MANCHESTER WATER SUPPLY.—The rain has interfered seriously with the laying of the second pipe from Thirlmere. It has, however, completely filled the Longdendale reservoirs.

THE INEFFICIENCY OF MODERN HOUSE DRAINAGE.

A GREAT deal of discussion has lately taken place, notably, at the Sanitary Congress recently held at Bradford, in respect to the defects, and also durability of stoneware pipe drains.

Will you kindly permit me to make a few remarks on this important subject from a practical point of view.

With regard to the present form of drainage there is, I believe, a consensus of opinion amongst sanitarians and others that the stoneware pipe as a material for house drains has proved a failure, and that it is useless to continue to construct drains with this material.

The best of these drains, however well the pipes are selected and laid, have only a comparatively short life, and although in theory the stoneware pipe forms a perfect drain, and should last for all time, yet, owing to its composition, and the physical agencies surrounding it, it has proved a decided failure.

In my experience as a building inspector to a Borough Council, I have had on an average some three or four hundred new drains to test and approve each year for the past twelve years, and careful observations made during that period has fully confirmed this view.

Is it not now time this fact was looked straight in the face, and more reliable material substituted in place of the stoneware pipe?

It is admitted that the introduction of the stoneware pipe drain many years ago has greatly improved sanitation, and thereby the health of the community, but the drain of the future will undoubtedly be as much in advance of the stoneware pipe as the stoneware pipe of its predecessor, the old brick drain.

It has been held as an axiom "that in the improvement of general hygiene the mortality has decreased, and the wellbeing and health of the community has increased in a corresponding ratio." Again, the late Sir B. W. Richardson says—"Cleanliness covers the whole field of sanitary labour, it is the beginning and the end, practised in its entirety, it would banish all disease from the world."

In the suggestion I have to offer, I shall endeavour to show to some extent how this may be in part accomplished, namely, by having clean drains internally and externally, sound and free from defects; this result, however, can only be obtained by entirely altering the present system of house drainage.

I do not claim originality in this suggestion, a somewhat similar idea was formulated by one of our leading sanitarians some few years since, but nothing more has been heard of it.

My suggestion is that the drain of the future will be of metal or glass, laid in a culvert built of brick or concrete, with stone cover, and chambers for access, and large enough to admit a man for the purpose of periodical inspection, the whole properly ventilated; in this culvert also the mains for water, gas, and electricity for the house can be laid.

It is admitted that this will add to the first cost, but it is a small matter compared with the advantage to be gained in having the drain at all times accessible and visible, and

also to know it is doing its work safely and well.

At the least intimation or suspicion of anything being wrong with the drains an examination can be made in a very short time and without cost.

What is the state of things at the present time? The drains are buried deep in the ground, and unless a hydraulic test be made, it is not known whether they are sound or defective, when defective the ground has to be opened up, the defect located and made good, and so this goes on from year to year, and all the time the ground surrounding and beneath the pipes is polluted with filth, making it a nursery for fevers and other disorders.

This applies more particularly to terrace houses, where drains are of necessity laid under the house.

Dr. Poore says—"It is highly probable that the culpable fouling of the soil practised by our forefathers and continued by ourselves has more to do with the propagation of disease than any property in the virgin soil itself."

But to resume,— the best material we have at the present time for drains is the cast-iron water pipe, the joints of which can be made absolutely water tight, the pipe, however, is not as satisfactory as it may be, owing to the surface inside being rough, and full of little inequalities of mounds and pits left from the casting; this, too, is emphasised when, for prevention of oxidation, it is treated with Dr. Angus Smith's solution, or subjected to the Barff process.

The pipe, to be successful, should be quite smooth inside, so that no mucus or film of excreta could attach itself, and for this reason it is suggested that the cast-iron pipe be bored through its entire length, to an even surface, and to a standard gauge, and then lined with a coating of white porcelain enamel properly burnt on, so that when finished the surface is perfectly smooth.

The jointing material to the pipes should be run lead properly caulked.

It is also suggested that terra cotta blocks or bearers be prepared for fixing or laying the pipes on, as shown in the sketch. These may be 3 in. or 4 in. wide and about 9 in. high, this arrangement keeps the pipe in its place, and well above the floor of the culvert, the blocks being fixed about 3 ft. apart.

Costly as this suggestion may be, it is undoubtedly cheaper to incur this expense than to incur the expense of re-instating drains every few years, as at present found to be necessary.

As an instance of one failure in particular out of many that have come under my notice, the drainage of a detached house built under an eminent London architect, the drains laid in the best possible manner with tested stoneware pipes, and under the constant supervision of a clerk of works, approved also by the local authorities, had to be taken up through defects, and re-instated a second and a third time within the space of 5 years at a cost of over 100*l.* each time. This cost, nuisance, and inconvenience would obviously have been saved had the system here suggested been adopted.

If it is held that it is impossible at the present time to produce enamelled iron pipes I would reply—that surely we have not arrived at the end of our discoveries in metallurgical and kindred sciences.

Is there no cheap form of obtaining aluminium, the compounds of which occur so abundantly around us in the rocks and soils? This metal could be made into pipes without inside enamelling, having no perceptible oxidation.

Then, too, there is the toughened, flexible, unbreakable glass (Bastie's process), introduced within recent times, with apparent success; this would be an ideal material for drain pipes if it could be got to fulfil these conditions economically.

But whatever material is ultimately selected for drain pipes, the laying or fixing should be in a culvert as before described, this being only a part of the whole scheme, as, in our "Model City" subways will be formed under the roads for sewers, water, gas, and electricity mains, which will be accessible at all times for the purpose of inspection, alterations, or repairs; and although we are not likely to have subways for some considerable time yet to come, there is no reason why the drainage of houses under this proposed new system should not be commenced almost at once.

Fame, if not fortune, should await the man who successfully initiates this system of house drainage, and he will undoubtedly render greater benefits to the community than even a Crœsus with all his wealth.

WM. R. PURCHASE.

THE SANITARY INSPECTORS' ASSOCIATION IN BELGIUM.

IN connexion with the International Health Congress recently held at Brussels, this Association paid a visit to several towns in Belgium, viz., Antwerp and Malines before the Congress, and Louvain, Ghent, and Bruges during and after the Congress. The President of the Association, Sir James Crichton Browne, LL.D., &c., the Chairman of the Council (Mr. Isaac Young), the hon. secretary (Mr. E. Tidman), and hon. treasurer (Mr. T. G. Dee) formed a special committee to carry out the arrangements.

The party, which included over sixty members of the Association, started for Antwerp via Dover and Ostend on Saturday morning, August 29, and in the evening they had a cordial reception at the Hotel de Ville by the Deputy Burgomaster. M. Victor Dequin and the chief members of the City Council, on behalf of the Burgomaster, M. Van Ryswick, who was seriously ill. After a very cordial welcome, M. Dequin referred with pleasure to a previous visit of the Association to Antwerp. Since that visit they had tried to profit by the good example shown to the world by English sanitary administration. Considerable progress had been made, and he trusted the members of the Association would give Antwerp credit for endeavouring to improve.

Sir James Crichton Browne thanked the Deputy-Burgomaster for his cordial welcome. They felt it a great compliment to have been received at so late an hour and they were all charmed with their entertainment in that beautiful building. Mr. Isaac Young also briefly responded and invited the Burgomaster and Deputy-Burgomaster to attend the annual banquet of the Association to be held in London in February next, at which it was hoped they would meet the Lord Mayor of London. Sunday and Monday were spent in visits to the monuments, museums, dispensaries and hospitals, and the sanitary and engineering works of the city under the guidance of the city engineer and M. Gustav Melius, chairman of the health department. The tour closed with the inspection of a Sewage Collector (System Harven), which has given very satisfactory results. Within forty-eight hours, nineteen-twentieths of the liquid portion of the sewage collected daily is returned to the river with all suspended matter abstracted and in a disinfected condition. The fœcal matters are preserved and applied from time to time as manure to the land. The economy effected is estimated at 12 fr. per head of the population per annum.

The most interesting of the series of visits was that made to the ancient city of Malines, the See of the Cardinal Archbishop, Primate of all Belgium. The visit commenced with an official reception at the Town Hall by M. Le Blus, Alderman for Public Works, members of the Council, the Town Clerk and the City Architect, M. Van Boxmeer, the latter conducting the visitors to see a number of the archæological masterpieces of which, as the City Architect declared at the luncheon, Malines contains a far larger number than many cities of much greater importance. The principal sanitary undertaking visited was the works that have been constructed to stop the inundation of the lower parts of the town by the River Dyle, which at certain parts of the year continually overflowed into the lower streets. The course of the river was turned by constructing sluices, one at a high level and one at a low level. By means of these sluices the flood waters are kept back, the height of the water being so regulated as to be prevented from entering the low-lying streets without in any degree hindering the entrance and departure of ships.

Of great interest was a visit to the works being carried out under the direction of the guide of the party (M. Philippe van Boxmeer) in the restoration of one of the most famous buildings of the sixteenth century, the palace of the Grand Council, erected by the Emperor Charles V., for a Supreme Court of Justice for the seventeen provinces of the Low Countries the plans of which were made by the Imperial Grand Architect, Reldermans. The ruins of this ancient palace have long been objects of the deepest interest to visitors to the Grand Palace at Malines, where they occupy the north-eastern angle. The restoration, under the hands of M. Van Boxmeer will not be completed for five or six years yet; the cost will be about 60,000*l.*, the funds being provided by the administration of the State Railways; and it is intended to be utilised as the Hotel des Postes. The facade towards the Grand Place occupies the old site of the Palais de Justice at the north-east corner, but it will have a frontage to the Rue de Beffer of over 200 ft.

The visit to Malines concluded with an inspection, by special authorisation of M. Francotte, Minister of Public Works, of the extensive locomotive and railway-carriage works of the Belgian State Railways. All the repairs and much of the new work connected with the network of State Railways in Belgium are effected at this great establishment, which covers an area of about 1,100,000 square yards, and employs on the average 3,400 workmen, about one-half in the locomotive department (which comprises forges, grinding, fitting, and erecting shops), and the other half in the carriage department. Under the guidance of M. Guillaume de Blieck, the chief engineer, the party spent two hours in the various departments, some of the chief objects of interest shown being a miniature locomotive with tender and train of passenger carriages to actual size, which will be sent to the New Orleans International Exhibition. At the end of one of the shops is a model in wood of an early English locomotive. It is a facsimile of the famous "Rocket," and was constructed in 1835 by an English engineer, the pioneer of the great firm of Cockerill and Sons, of Seraing, who settled in Belgium about seventy years ago.

During the sittings of the Congress the sanitary inspectors were among the most assiduous of the members attending, but they found time for another official visit on Sunday, the 6th. Congress not being in session on that day the party, under the guidance of Sir James Crichton Browne, took an excursion to Louvain, where they had an official reception at the Hotel de Ville, and were entertained with the same hospitality they had met with at Antwerp. After the close of the Congress similar official visits were made to Ghent and Bruyes, the party returning via Ostend to London.

ARCHITECTURAL SOCIETIES.

LEEDS AND YORKSHIRE ARCHITECTURAL SOCIETY.—On Thursday, the 10th inst., the President (Mr. Butler Wilson) and Council of the Leeds and Yorkshire Architectural Society entertained the members of the Library Association, who are holding their annual conference in Leeds, to a smoking concert at the Queen's Hotel, to meet the members of the Leeds Savage Club. Among those present were the Lord Mayor of Leeds (Mr. John Ward), Professor Macneile Dixon (President of the Library Association), the Vicar of Leeds (Dr. Gibson), Sir W. H. Bailey, Lieutenant-Colonel Robinson, Mr. Edmund Bogg (chief of the Leeds Savage Club), the Rev. N. Egerton Leigh, Dr. Coleman, Mr. F. H. Barr, and Councillor S. A. Hirst.

NORTHERN ARCHITECTURAL ASSOCIATION.—The past-President, Mr. W. Glover, has presented the Association with 1,000*l.* of Consols, invested in the names of the President and Hon. Secretary as trustees. Not less than one-quarter or more than one-half of this capital may be withdrawn at a future date towards the cost of a building for the Association. The annual interest is to be used for the Society's educational work.

KING'S COLLEGE, LONDON.—The Division of Architecture, which was separately constituted a year ago, will resume work on October 1, when the various courses of lectures and the studio for day students will be opened. A feature of the past session has been a visit paid by the students for measuring and sketching to Oxford, and it is intended to arrange a similar week's visit to some centre of architectural interest during the Easter vacation of the new session. The evening lectures and the studio for evening students supported by the Carpenters' Company will open on Monday, September 28, when there will be a short opening lecture by the Professor, and new students can be enrolled. The evening fees have been somewhat reduced in most of the evening classes, and the Carpenters' Company are prepared to grant nominations to deserving students as in previous years.

Decorative Panel: "Music." By Mr. J. Allan Hughes.

DECORATIVE PANEL: "MUSIC."

THIS pretty and original decorative panel is reproduced from a small water-colour drawing which was in the last Royal Academy Exhibition, and was referred to in our review of the Architectural Room exhibits.

It is one of a number of panels for the music-room of a house at Kew, a few miles from Melbourne (Australia), in which neighbourhood the artist, Mr. J. A. Hughes, of London, is represented by a good deal of stained glass and other decorative art.

A MONUMENT TO MILTON IN ST. GILES'S, CRIPPLEGATE.

A COMMITTEE appointed by the Vestry of St. Giles's Without, Cripplegate, have received promises from the parishioners, and the Goldsmiths' and Clothworkers' Companies, who are the ground landlords of some property in the vicinity, towards a fund, estimated at 3,500*l.* in all, in respect of a proposed local improvement. The project embraces a restoration of the north wall of the church which is now revealed by the recent demolition (for a widening of Fore-street) of the Quest House and the "Four Shoppes" which blocked in the church on that side, and the laying out of the ground thus cleared. The Ecclesiastical Commissioners have agreed to sell for 1,400*l.* a portion of the surplus land with a condition that it shall not be reconverted for building purposes, and the Committee seek to collect another sum of 1,500*l.* to enable them to buy from the Corporation of the City the remainder of the land lying at the north-west side of the Church for the erection thereon of a statue in honour of Milton. We may mention that a bust by John Bacon the elder was placed in the nave of the church in 1793 by Samuel Whitbread, of the brewery in Chiswell-street, and just forty years ago the bust was set up in a canopy, erected by public subscription, in the south aisle. The Committee, however, wish to avail themselves of the offer, lately made by Mr. Deputy Baddeley, of a more worthy memorial to stand outside, where it can be always seen. Milton was buried on November 12, 1674, in, or close by, his father's grave in the upper end of the chancel. The gravestone was displaced five years afterwards; the popular belief that the poet's remains were exposed to view and subjected to desecration during the repair and raising of the chancel floor in August, 1790, has been discredited by subsequent investigations. In our columns of March 30, 1901, and February 21, 1903, we illustrated and described the old buildings that were pulled down seven months ago. The gatehouse, built in 1660, will, it is stated, be re-erected near the church. In 1885, under the supervision of Edmund Woodthorpe, the external stonework of the south and west walls of the church was restored, and a facing of Kentish rag-stone was substituted for the brickwork of the south-east octagon tower containing the staircase entrance to the galleries (now removed) and of the clear-story, which is, together with the tower, now surmounted with battlements; subsequent repairs have been carried out under Mr. F. Hammond's superintendence. A similar tower, which contained a staircase leading to the roof, standing against the western end of the north wall of the church is now exposed to view, as also is the former entrance into the church on that side, where two of the aisle windows are at present filled in with brickwork.

THE ASSOCIATED PORTLAND CEMENT MANUFACTURERS.—The report to be submitted to the fourth meeting of the company on the 23rd inst. states that upwards of 220,000 tons of cement have been produced by the new rotary kiln plant at Swanscombe since its erection. It is stated that this cement conforms to the most stringent specifications. An installation has just been completed at the Arlesey Works, and the erection of another plant is in progress on the Thames.

TRADE CATALOGUES.

MR. THOMAS W. CAMM sends us a pamphlet containing illustrations of stained glass windows carried out by himself "with the assistance of craftsmen under his direction," at his studio at Smethwick (Birmingham). This must be placed under the head of "Trade Catalogues," but it is in a different spirit from many of them; the work shown is pervaded by artistic feeling and aim, and the preliminary essay on "Technique and General Principles" contains a great deal of useful information and criticism on the conditions of stained glass art. As far as one can judge of stained glass from small photographs, Mr. Camm's productions produce a good impression, and he suggests some new fields in the way of subjects; for instance, "The Assault on the Town of Mansoul," from Bunyan's "Holy War," which, however, there is a little too much of background and perspective for stained glass, a fault which most of the designs keep clear of. Both the "Holy War" and Bunyan's greater and better known allegory might be far more drawn upon than they are, for religious decorative art both in painting and stained glass.

The London Drawing and Tracing Office send us a pamphlet giving reduced illustrations of the work they can supply in drawing, making models, and photographic copying of drawings and tracings. The drawings, as far as one can judge from small reductions, are (as might be expected) rather hard and mechanical in style, but they are evidently carefully and correctly executed, and answer their practical purpose of showing the building perfectly well. No scale of charges is given for the execution of perspectives, but estimates can be furnished for each case, if requred.

Messrs. Claughton Bros. (Bramley, Leeds) send us their illustrated price list of cast-lead rain-water heads, sockets, and ornaments.

We have received a comprehensive list of standard continuous current dynamos from the General Electric Company, of Queen Victoria-street. We are pleased to see that considerable progress has been made in the "standardisation" of this type of machine. Two types of dynamos are made, the "open protected pattern" for small outputs, and the "open multipolar pattern" for large outputs. They are built on modern lines, and all parts are interchangeable and made to gauge. The catalogue gives a concise specification to which they conform, and tables of weights and shipping dimensions are given. The General Electric Company has also laid down complete plant for the manufacture of arc-lamp carbons, and from personal experience we have found these carbons satisfactory. They burn with an even light, even when they are arranged in five lamps in series across a 220 volt circuit, and they make very little ash.

BOOKS RECEIVED.

WATER SUPPLY: A STUDENT'S HANDBOOK. By Reginald E. Middleton, M.Inst.C.E., etc. (C. Griffin and Co.) 8s. 6d.

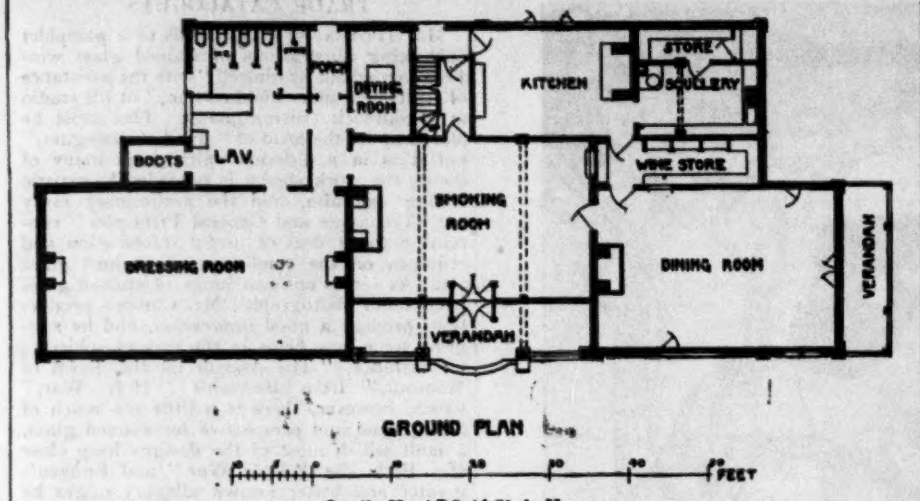
GOVERNORS AND GOVERNING MECHANISM. By H. R. Hall. (The Technical Publishing Co. 2s. 6d.)

THE MANUFACTURE OF IRON AND STEEL TUBES. By E. C. R. Marks. Second edition. (The Technical Publishing Co. 5s.)

ECONOMIC NOTES ON INSULAR FREE TRADE. By the Right Hon. A. J. Balfour, M.P. (Longmans and Co. 1s.)

MICHAEL ANGELO BUONAROTTI. By Lord Ronald Sutherland Gower, F.S.A. (Geo. Bell and Sons. 5s.)

STRENGTHENING LEADED GLAZING.—We have had an opportunity of examining a new system for strengthening leaded windows, patented by Messrs. W. James and Co., of Kentish Town. The object is to do away, except in the case of very large windows, with the saddle-bar; and with this object the leading is strengthened at convenient points by thin steel bars soldered into the lead, and following its lines. The main advantage is that the straight line of the saddle-bar, cutting through the design, is avoided, and when the window is seen against the light the steel slips, which follow the line of the leading, are entirely invisible. There is also the advantage, for domestic glass especially, of getting rid of the copper ties, which are often an inconvenience and which require renewing. It is for domestic stained glass, in fact, that the system is more especially intended; and for this it possesses some very manifest advantages.



South Herts Golf-Club House.

Illustrations.

WEST FRONT, HEREFORD CATHEDRAL.

THE new west front of Hereford Cathedral, which is here illustrated, is in course of erection from the designs and under the superintendence of Mr. J. Oldrid Scott, in substitution for that which was designed by Wyatt after the great collapse which happened towards the end of the eighteenth century.

The west window is a memorial to the late Queen, provided by the ladies of Herefordshire; the remainder of the work is being done partly by the Dean and Chapter and partly by public subscription.

Brown Hollington stone is being used for the work. The west window and gable above are now completed, and the projecting porch below, with the new west doorway, is in progress. The aisles, with their turrets, will be proceeded with as soon as funds are available. The total cost of the work will probably be about 17,000*l*.

The contractors are Messrs. Thompson, of Peterborough.

The drawing was exhibited at the last Royal Academy Exhibition.

HOUSE, HADLEY-ROAD, MIDDLESEX.

THIS house, now in course of construction, commands good views of the well-wooded country in Hertfordshire and the north of Middlesex. Ham Hill stone is employed in conjunction with a reddish-brown brick, and the roof is covered with a sand-faced tile. The effect produced is quiet in colour and in harmony with the rural surroundings.

The house is warmed by low-pressure hot water, and is lighted with acetylene gas.

The builders are Messrs. Allen Fairhead and Son, of Enfield Town, and the architect is Mr. A. H. Hart.

The drawing was exhibited at this year's Royal Academy.

SOUTH HERTS GOLF-CLUB HOUSE.

THIS house, erected for the South Herts Golf Club from the designs of Messrs. A. C. Dickie and W. Curtis Green, is of brick and roughcast, with a tile roof, and is built to accommodate 325 members. The verandah is of wood painted white.

It is a satisfactory attempt to give a certain degree of architectural character to an erection of this kind.

SANATORIUM, SHREWSBURY SCHOOL.

THIS building consists on the upper floor of three wards of one bed each, and one ward for two beds, nurses' room, bathroom, water-closet, and slop sink. On the ground floor are sitting-room and bedroom for housekeeper, servants' bedroom, storeroom for medical officer, kitchen, scullery, &c.

The iron ward was intended to meet the possible occurrence of an epidemic, while the small wards in the permanent building were for isolating the initial cases.

The building was erected by Mr. Bowdler, of Shrewsbury, and the cost was just over 2,000*l*.

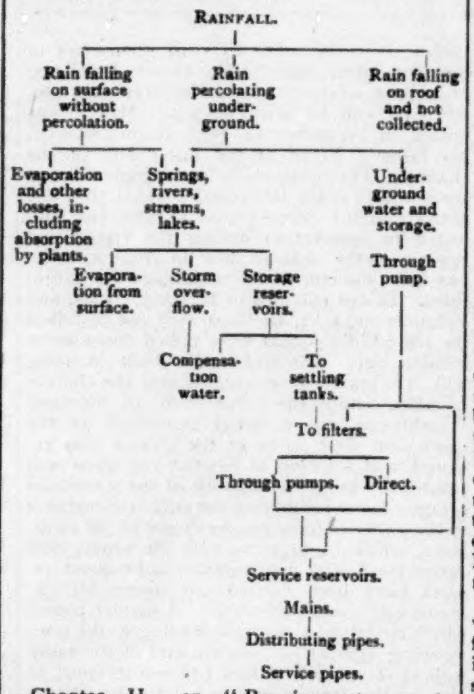
KEITH D. YOUNG.

Books.

Water Supply: A Student's Handbook on the Conditions Governing the Selection of Sources and the Distribution of Water. By REGINALD E. MIDDLETON, M.Inst.C.E., M. Inst. Mech.E., F.S.I., with numerous illustrations, plans, and tables. London: Charles Griffin and Co. 1903.

IN this treatise the author, whose name is intimately associated with the new reservoirs at Staines, has more than fulfilled the promise contained in the title as quoted above, and although the volume now before us contains less than 200 pages, it includes, in addition to a consideration of the conditions governing the selection of sources and the distribution of water, some chapters relative to engineering details that will be found of practical service to engineers and engineering students.

Chapter I. serves as an introduction to the various points to be considered in arranging and elaborating a scheme of water supply, and the gist of this preliminary discussion is thus summarised by the author:—



Chapter II., on "Requirements as to Quality," commences with a statement, the accuracy of which is fully borne out by experience, to the effect that even if it were possible to obtain chemically pure water, this would not be an unmitigated advantage, as the presence of certain impurities, in the sense of foreign matters, might prove desirable, rather than objectionable. The chief point for the water engineer is to know precisely which impurities are harmless and admissible, and which are harmful and inadmissible. This chapter sets forth with clearness the points to be remembered, and indicates the sources of supply that, as a general rule, are most advantageous for adoption; but the most useful advice given is perhaps that to be found in a paragraph wherein the engineer is recommended to obtain the opinion of a competent analyst before deciding upon any particular source.

"Requirements as to Quantity" receive adequate treatment in Chapter III., wherein are collected useful data as to consumption, and methods are described for estimating the increased demands that may arise from the growth of population, and the quantities of water available from given catchment areas and wells. In the two chapters succeeding, devoted to "Storage Reservoirs" and "Masonry Dams" respectively, we enter upon matters of constructional interest. After dealing with questions affecting capacities and sites Mr. Middleton illustrates the method of designing earthwork dams, giving preference to the British practice of employing a puddle wall of clay, for the purpose of preventing the percolation of stored water through the dam. As he points out, concrete or rubble walls, as sometimes used in the United States, often leak to a serious extent, and in some types of such construction there is risk that the wall may fail at or above ground level. Another American expedient, that is not mentioned in the present treatise, is the substitution of a steel plate in lieu of the puddle wall. This may be justifiable on temporary work, but for permanent dams it is scarcely to be recommended, and Mr. Middleton is wise in adhering to methods that have been proved by long experience to be trustworthy in every sense of the word. As an instance of an earthen bank, the Staines Reservoir is cited, and a section is given showing the details of the construction adopted in that work. Masonry Dams, forming the subject of the second of these chapters, are considered in sufficient detail; simple rules are given for the calculation of all essential loads and stresses, and a worked example makes the application of the rules perfectly clear. The next part of the subject approached is the "Purification of Water," and we note that the author favours the method of slow filtration, through sand, which after all seems to be the best suited for this country, and gives results that are fully equal, and perhaps superior, to the various processes that are favoured elsewhere. In the case of hard waters, the adoption of a softening process ought certainly to be considered by water companies, but in other respects it is very unlikely that any radical alteration is advisable in methods of purification on a large scale. Mr. Middleton makes brief mention of Clark's process of softening, but does not in any way emphasise the advantages to be obtained by its employment. "Service Reservoirs" are briefly considered in Chapter VII., and the main essentials of construction are discussed. A chapter of service to all concerned in water supplies is that devoted to "The Flow of Water Through Pipes," a subject upon which much has been written, and which is more or less shrouded by the mists given off by many mathematical formulas. Mr. Middleton here performs a service for which students have reason to be grateful. After showing that the theoretical basis of all such computations in itself presents little difficulty, and that the existing confusion arises from variable experimental co-efficients, expressed in different terms by different writers, he commences consideration of the subject at the beginning and gives, in simple terms, all the rules necessary for calculation. Following this demonstration we find rules for the strength of pipes, mains, and fittings. The last three chapters make brief reference to "Distribution Systems," "Pumping Machinery," and some "Requirements in Connexion with Waterworks.

It is not suggested by the author that this work constitutes a complete course of study for the waterworks engineer. On the contrary, it is professedly intended to set forth the general scientific principles upon which this department of engineering is based, and to serve as an introduction to more elaborate treatises. These objects appear to be admirably attained. The treatise is most clearly written, well illustrated, and every page carries with it sufficient proof that it has been written by an engineer who is practically and intimately acquainted with his subject.

Practical Masonry: A Guide to the Art of Stone Cutting. By WILLIAM R. PURCHASE. Fourth edition, enlarged. London: Crosby Lockwood and Son. 1903.

As in previous editions of this eminently practical work have already been reviewed in our

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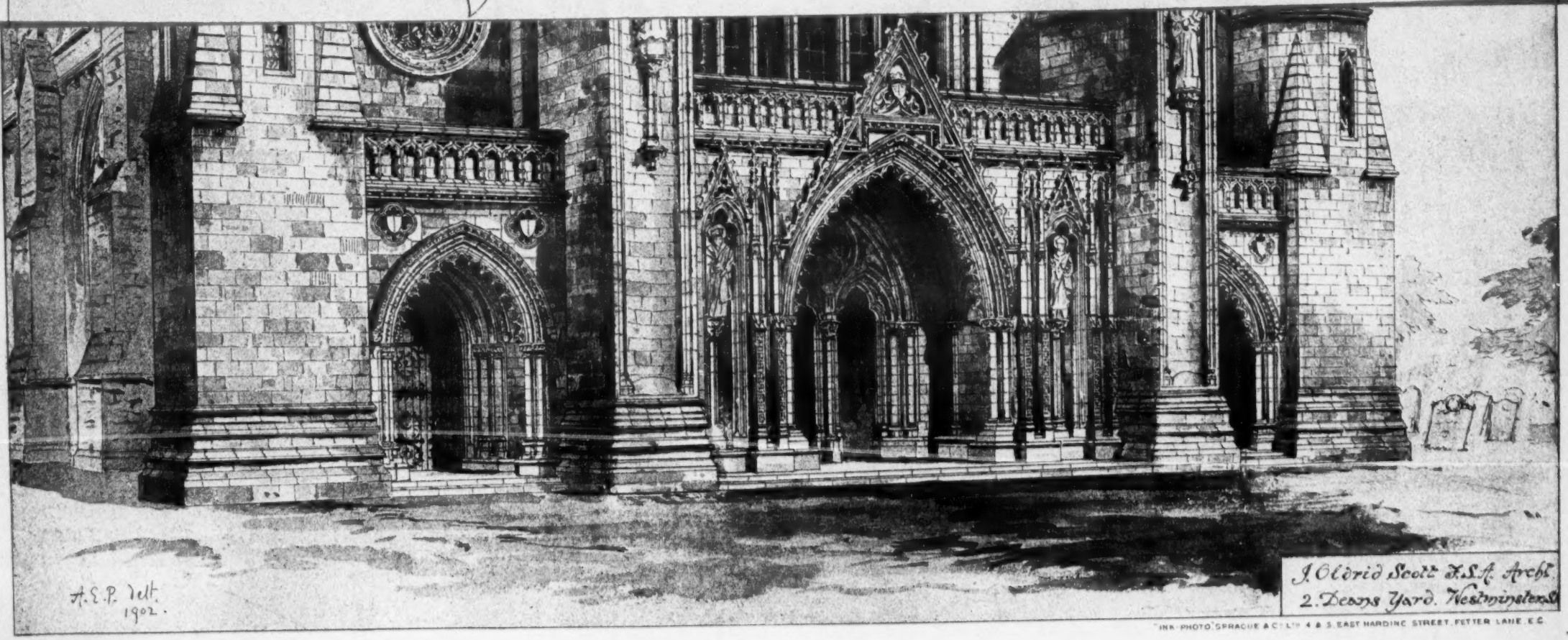
Design for New West Front



A. E. P. delt. 1902.

J. Oldrid Scott F.S.A. Archt. 2. Deans Yard. Westminster S.W.

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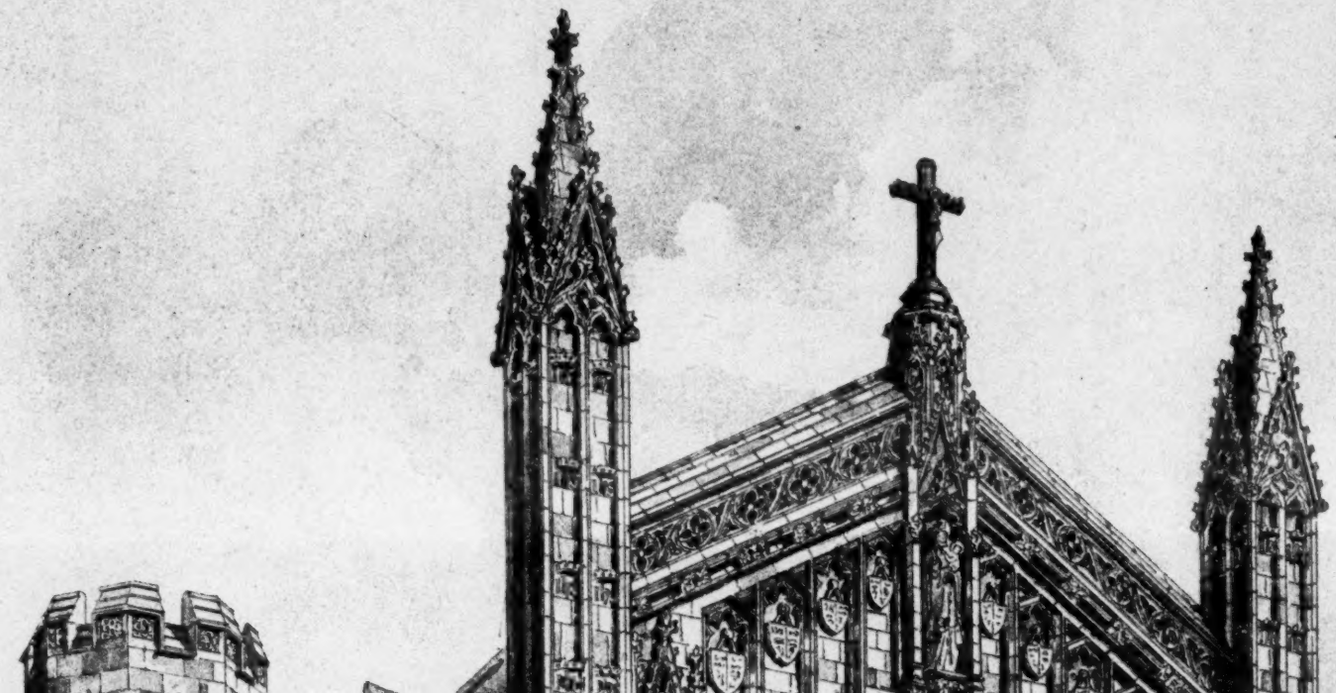
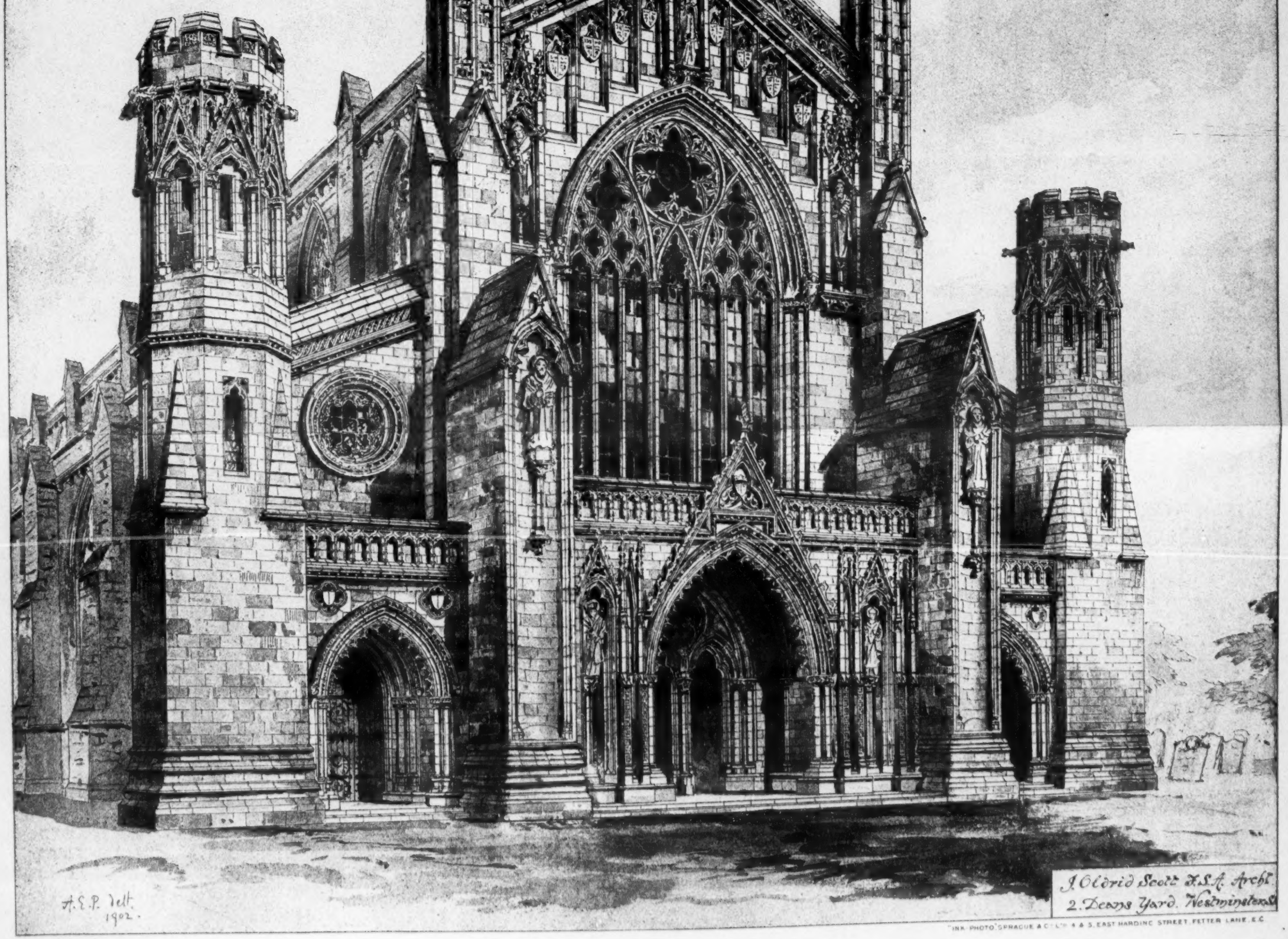
Hereford Cathedral.
Design for New West Front





A.E.P. delt.
1902.

J. Oldrid Scott F.S.A. Archt.
2. Deans Yard. Westminster.

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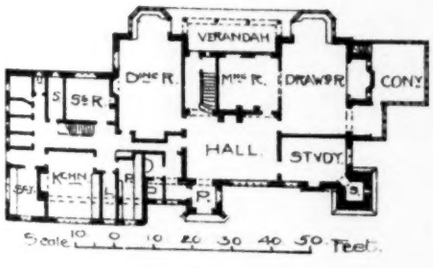
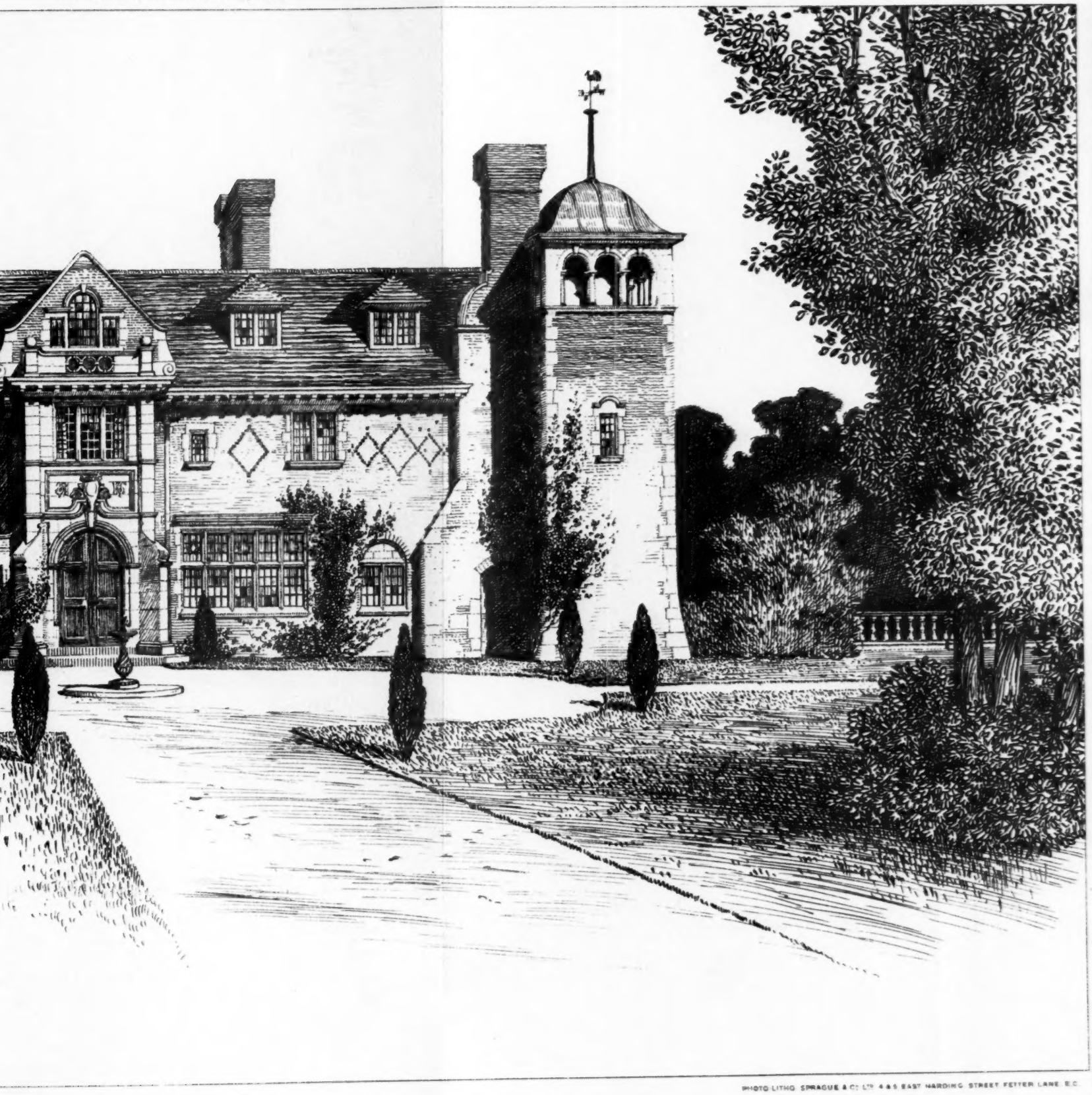


HOUSE ON THE HADLEY ROAD.

MIDDLESEX.

ALFRED H HART ARCHT
1. VERULAM BUILDINGS.
W.C.



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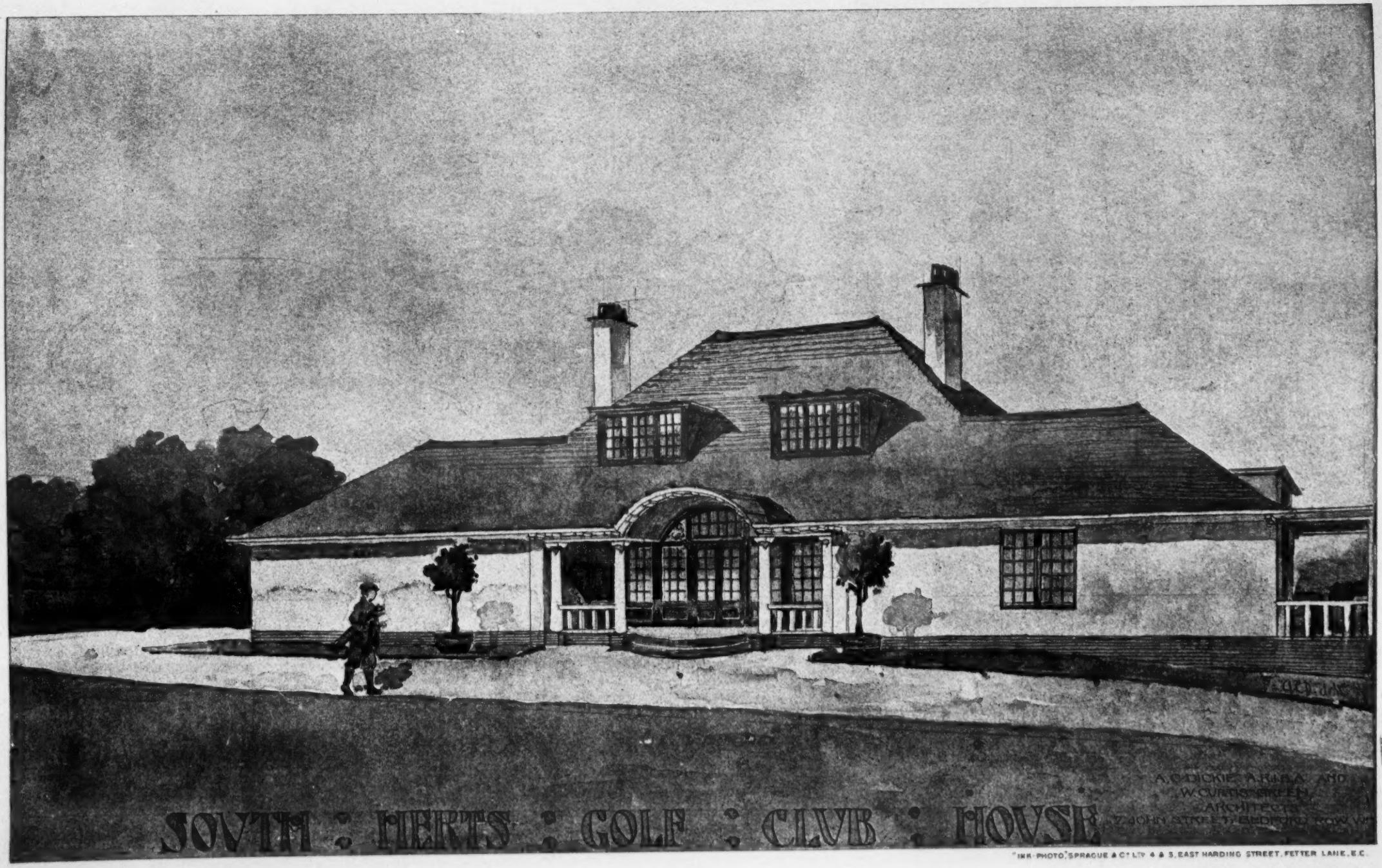

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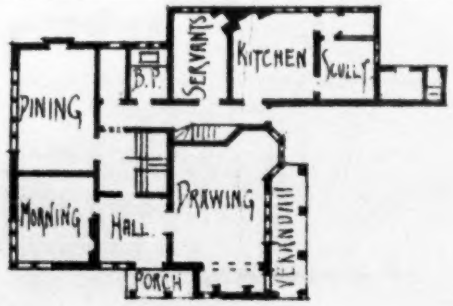

House at Farnboro'

Mr Paxton H. Watson
Architect

A. Cox. delt.

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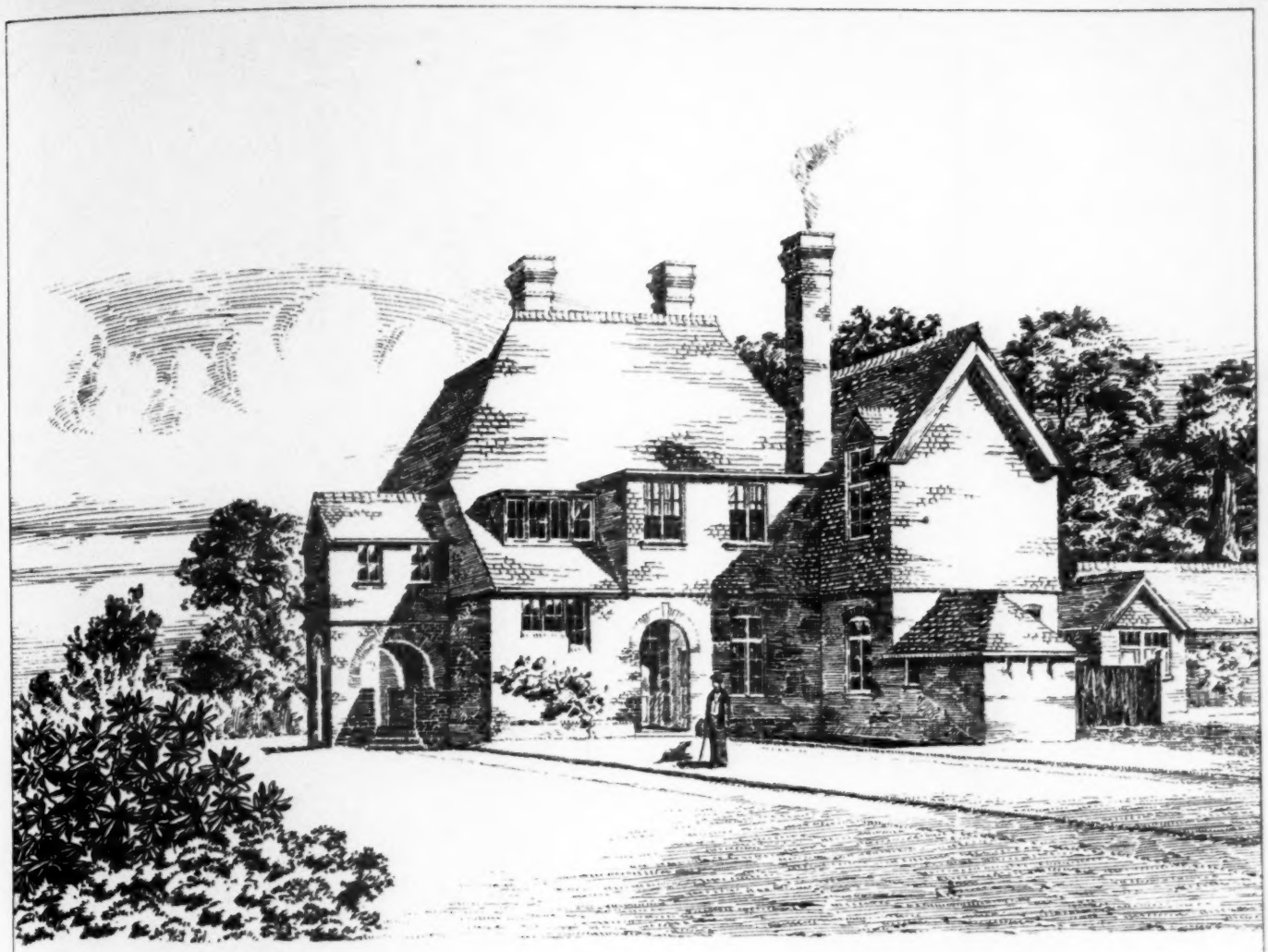

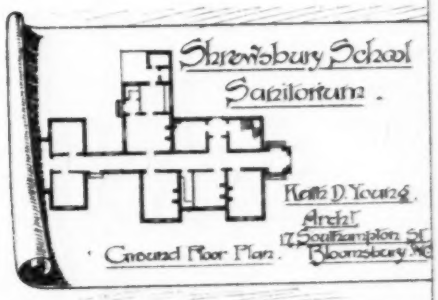

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columns, it is only necessary to refer to the additional matter now included. This comprises new sections relative to masonry estimating and quantity surveying, and to building stones. In the first of these sections the author emphasises the assistance afforded to the estimator by familiarity with constructional drawings and specifications, by a sufficient knowledge of mathematics, and finally, by a "neat and methodical way of taking off quantity." As our readers are aware, there is considerable diversity of opinion as to the best system for adoption in estimating for stonework, and it appears to us that the author is right in advocating the claims of what is known as the "London system." After some necessary definitions, complete examples of taking-off quantities are given, and in the first example an abstract is prepared, put into bill form, and priced. This mode of treatment serves to make very plain the method to be followed by the mason in actual practice.

The section on building stones contains a discussion of the chief points with which the mason should be acquainted, and following this is a very serviceable list of the principal quarries, chiefly in Great Britain, furnishing stone of various kinds for building purposes. The list gives the characteristics of the different stones mentioned, weights, prices, and other useful particulars. It is not quite so complete as could be wished, but this circumstance is attributed by the author to the reluctance of some merchants and quarry owners to afford information. The additions to which we refer add considerably to the value of this useful treatise.

The Engineer in South Africa. A Review of the Industrial Situation in South Africa after the War, and a Forecast of the Possibilities of the Country. By STAFFORD RANSOME, M.Inst.C.E., Westminster. Archibald Constable and Co., London, 1903.

ALTHOUGH the greater part of the matter contained in this volume has appeared in the columns of our contemporary the *Engineer* in the form of articles, entitled "South Africa, from an Engineer's Point of View," the present book is not a reprint in the ordinary sense of the term. Much of the original matter has been eliminated, while the remainder has been rearranged, and to a considerable extent rewritten, by the author. The early portion of the work is occupied with a consideration of various problems such as the cost of living and travelling, the prospects of employment, the labour question and intercolonial relations, and the influence of politics upon industrial questions. In the later chapters the author treats of the more important engineering industries of South Africa as carried on in the present day, and gives his opinion as to their prospects and possibilities. It is interesting to observe an expression of the opinion that there is no foundation for the attacks sometimes made on the methods of the British manufacturer, and in support of this conclusion the author points to the fact that the imports from Great Britain for 1902 are just double those for 1898, which was the last normal year before the war.

In Chapter XIII. we have a discussion of "The Theory and Practice of the Railways," showing, among other things, that railway design in the past has been dictated almost entirely by political, rather than by commercial, considerations, and that even now railway routes form the subject for fiery controversy in the self-governing Colonies of South Africa. Mr. Ransome properly emphasises the fact that Johannesburg, "the centre of all things South African," should be the centre of all the railway systems, or, to use his own words, "It is essential above every other consideration that all roads should lead to Johannesburg, and by the shortest routes."

The opinion is sometimes expressed that South Africa is badly provided with harbours. This may be correct in one way, but the deficiency is due to human and not to natural causes. Although the author devotes only two short chapters to this important subject, he succeeds in making tolerably clear the influences that have militated in the past against the development of South African harbours. At the same time, it is singular that all mention of the extensive harbour works now in progress at Cape Town should be entirely overlooked by Mr. Ransome. The reason may be that these works were not authorised at the time of his visit to South Africa; but as his book has only just been issued by the publishers, there has been plenty of time for obtaining recent information and for correcting comments and criticisms that are no longer applicable to the port in question. Passing over three chapters relating to diamond and gold mining, we come to some serviceable remarks upon "Well Boring in Cape Colony" and "Irrigation." The opinion of the author is that there will be a very considerable extension of well-boring in the near future, as beneath the greater portion of the drought-stricken area in the interior of South Africa there are plentiful supplies of water that only require tapping to be brought to the surface. With regard to irrigation, the author says the position is disappointing, apparently not because irrigation is impracticable, but for the reason that it could only be successful on a large scale if sweeping alterations were made in laws relating to water throughout the South African Colonies. While dealing with this important subject, Mr. Ransome makes reference to the report by Sir W. Willcocks on irrigation in South Africa, which he justly describes as the "only work worth reading on the subject."

The volume is well illustrated with photographs, maps, and drawings, and should be of considerable service to those who desire reliable information with regard to South Africa.

The Elements of Electrical Engineering. By T. SEWELL, A.I.E.E. Second Edition, Revised and Enlarged. London: Crosby Lockwood and Son. 1903.

THE author has considerably improved the original part of this work by rewriting certain portions of it, and so some of our previous criticisms no longer apply. He has added three chapters on alternating current theory, and has endeavoured to cover nearly all the field now explored in these three chapters.

In the preface he says: "I have made free use of vector diagrams in the new chapters. By their aid the student is often able to perceive readily what would otherwise involve a difficult or tedious mathematical demonstration." Whilst quite willing to grant that vector diagrams are a practical necessity for engineers in works, we do not at all agree that they are superior to "difficult or tedious mathematical demonstrations," as a student reading the preface would naturally infer. As a matter of fact, they are merely a shorthand way of expressing the mathematical equations, and to advanced electricians they are practically useless. The Heyland diagram for an induction motor, for example, is built up of a large number of vectors, but it is far from accurate.

The references to "dielectric hysteresis" and to "splashing" are misleading. In our opinion, neither phenomenon occurs, and the true explanations as given by Rayleigh and Heaviside are something very much simpler than the involved explanations recently given in the "Journal of the Institution of Electrical Engineers." It is wrong to state that "the field created by the current in a conductor springs from the centre as a number of expanding rings." A little further on it is stated more correctly "the current will grow in the outer portion of the conductor first," and it is stated that with high frequencies, there is practically no current, and surely therefore practically no "expanding rings" in the centre portion of the conductor.

It would be possible for a non-mathematical student to acquire a considerable knowledge of alternating current theory from the new chapters. Many of the every-day phenomena are described and clear diagrams are given. We doubt, however, whether his knowledge would be a great help to him. We are old-fashioned enough to believe in giving tedious proofs when no others are available, in worrying out difficulties, and in stating clearly the limitations in our methods, and the assumptions involved in our proofs.

NEW STREETS, ABERDEEN.—At a meeting of the Streets and Roads Committee of the Aberdeen Town Council on the 10th inst.—Lord Provost Walker presiding—the plan of the new street to be carried from Marywell-street to Portland-street—as prepared by Mr. P. M. Barnett, engineer-in-chief of the Great North Railway—was submitted. The new street takes the place of Wellington-road, which is to be absorbed by the widening of the railway. A new sewer has also to be constructed in the street. The plan, having been approved by the burgh surveyor, was passed.

Correspondence.

THE CAMBRIAN ARCHÆOLOGICAL MEETING.

SIR,—Might I be permitted to make a few corrections on three subjects touched upon by the writer of the interesting account of the Cambrian Archæological Association meeting at Portmadoc, which appeared in your issue of August 29?

In his survey of the day's excursion into the Beddgelert district, he refers to Sir John Williams as goldsmith to King Charles II. I would point out that a certificate (21 James I., 1623) was granted by the Earl of Suffolk and Sir Henry Cary "that there is no evidence that John Williams, the King's goldsmith, hath sold deceitful plate to the King"; and in further proof, I would add that the silver chalice and paten, still in use at Beddgelert church, were given in 1610 by this same Sir John Williams; and also that, assuming your correspondent's reference to the friendship existing between Sir John Williams and the poet Drayton to be correct, the date of Drayton's death, 1631, would establish the fact that Williams was not goldsmith to Charles II.

The ancient British boat, exhibited at Portmadoc, was not, as your correspondent remarks, illustrated in "Archæologia Cambrensis" '4th series, vol. V.). It was merely described, not illustrated. The drawing referred to was of another boat. The two triangular supports were added a few years ago, and are not therefore original, as would be inferred from your writer's description of the boat.

There are several errors in his paragraph describing the church plate exhibited. A student of old English silver, reading his account, would naturally expect to find an early and rare example of old church plate when certain specimens are placed in the forefront and referred to in this manner: "Standing out from the general collection were a silver cup and dish, the later used as a paten, from Treflys." To my mind, these were the least interesting of the pieces exhibited, for the chalice bears neither inscription nor hall-marks, and judging from its form, is obviously of late date, probably eighteenth century. The dish is not even silver, and is an ordinary dinner-plate, made of "Sheffield plate."

The Criccieth chalice was hall-marked at Chester in 1770, and was the gift to the church of John Jones, of Brynhir. Its form alone is sufficient evidence of the fallacy of your writer's assignation of it to the previous century.

Your correspondent refers to the Llanarmon chalice as being the gift of John Thomas Wynne. This is an error, for this chalice is not inscribed, and no record of its donor can be discovered in the parish. The chalice from the mother-church of Llangybi was given by one Wynne, and this perhaps was the vessel your writer had in mind.

The double-handled pewter cup from Llanengan church is not to be compared for rarity and interest to the pewter cup, of earlier date, from Llanfrothen, which is not mentioned.

The two small pewter cups with covers, which he considers probably pax cups, are in all probability mustard pots of early nineteenth century manufacture.

E. ALFRED JONES.

Queen's Hotel, Portmadoc.

*** The writer of the report observes:—"I am much obliged by Mr. E. Alfred Jones's corrections of certain errors which crept into the account of the Cambrian Archæological Association's meeting at Portmadoc. That account was written far from any books of reference of even the most elementary character. The temporary museum was also examined under unfavourable circumstances, and after some of the objects had been removed, and others apparently disarranged."

GERMAN PATENTS.

SIR,—Although Germany acceded to the International Convention on May 1 last, with the result that anyone who has applied for a patent in Great Britain (and other States of the Union) can claim twelve months priority in Germany from the date of the first filed applications, we would point out that no such priority can be claimed in respect of patent applications filed prior to May 1 last, and that in all such cases the German patent must be applied for before any printed publication of the invention has taken place in any country.

E. P. ALEXANDER AND SON,
Chartered Patent Agents.

PROPOSED FREE LIBRARY, PONTEFRACT.—The Pontefract Town Council have approved the plans presented by Messrs. Garside and Pennington, honorary architects, for the proposed Free Library for Pontefract. The building will occupy a site in Salter-row, on the present lawn in front of the Municipal Offices. The cost is estimated at 2,000*l*.

The Student's Column.

CONCRETE STEEL.—XII.

MR. JOHNSON'S THEORY OF BEAM DESIGN.

ANOTHER series of formulæ for calculating the strength of concrete steel beams, in which due attention is given to the effects of the co-efficients of elasticity for concrete and steel, was made public in 1901 by Mr. A. L. Johnson at a meeting of the American Society of Civil Engineers.* The formulæ are perfectly suitable for general use, as they have no relation to any of the specific styles of concrete steel construction favoured by various patentees. They are based upon the assumption that the concrete in tension is of no value in the moment of resistance of the cross-section, and the following is the notation adopted :—

E_s = Coefficient of elasticity of steel, in pounds per square inch ;
E_c = Coefficient of elasticity of concrete in compression, in pounds per square inch ;
F = Elastic limit of steel, in pounds per square inch.
f_c = Compressive strength of concrete, in pounds per square inch ;
b = Width of section considered, in inches ;
a^2 = Area of reinforcement, in square inches ;
d = Spacing of reinforcement, in inches ;
$\frac{a^2}{d}$ = Amount of metal per inch in width of beam, in square inches ;
M_o = Moment of ultimate resistance of cross-section, in inch-pounds, for failure in tension ;
M^1_o = Moment of ultimate resistance of cross-section, in inch-pounds, for failure in compression ;
M = Bending moment of external forces, in inch-pounds ;
W = Total load on beam, in pounds ;
w = Uniformly distributed load, in pounds per square foot ;
P_s = Total stress on metal in width b ;
P_c = Total stress on concrete on width b ;
λ_1 = Unit strain of extreme fibre in compression ;
λ_2 = Unit strain of steel ;
e = Distance from the bottom of the concrete to the middle plane of the reinforcement, in inches ;
y_1 = Distance between the top of the beam and the neutral axis, in inches ;
y_2 = Distance between the middle plane of the reinforcement and the neutral axis, in inches ;
t = Total depth of the beam, in inches ;

As at the maximum load, the stress developed in the metal cannot be much greater than its elastic limit, Mr. Johnson advocates the employment of steel with an elastic limit as high as may be consistent with the ductility desirable in any particular construction.

We have already shown that it is possible to break the metal reinforcement in a beam, but it should be remembered that the intensity of stress involved cannot be developed until the construction as a whole has far exceeded its maximum load-carrying capacity. Under these circumstances it is quite correct to assume that the co-efficient of elasticity of the steel is constant up to the development of the value F, which represents the elastic limit, and when this point is reached the construction as a whole has practicaly attained its maximum resistance.

A similar condition does not obtain so far as concerns the concrete in compression, for the maximum carrying capacity is not reached until the extreme fibre stress becomes equal to the compressive strength of the material. Whether the maximum capacity can be so attained depends upon the strength and amount of the reinforcement. In the case of the beams tested by Professor Hatt, to which reference has previously been made, the reinforcement was not adequate for developing the maximum strength of the concrete. Assuming such development to be attained, Mr. Johnson finds the stress diagram above the neutral axis to be shown in Fig. 20, and he states that this representation was deduced from the examination of numerous stress diagrams for both stone and cinder concretes of average proportions. On this diagram the total stress P_c, equal to the area of the shaded part, is about 25 per cent. greater than the area between the lines $o\ n$, $o\ s$, $n\ s$.

Similarly, it was ascertained that the co-efficient of elasticity as represented by the tangent of the angle $n\ o\ s$ is only two-thirds the value of the original co-efficient for stone concrete and only one-half the value of the original co-efficient for cinder concrete, the original value being represented by the tangent of the angle $m\ o\ s$.

* *Proc. Am. Soc. C.E. Vol. XXVII., No. 6.*

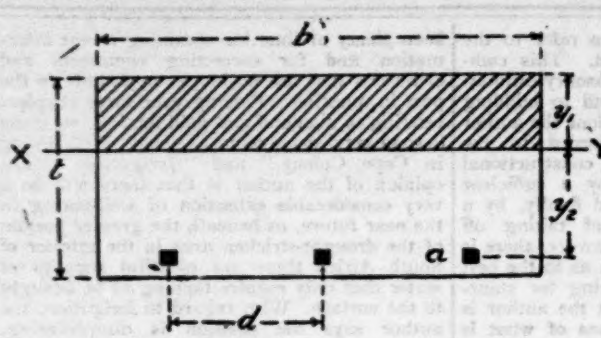

Fig. 19. *Fig. 20.*

Illustrations to Student's Column.

The following demonstration relates to formulæ for single-span beams supported at the ends, and reference to Figs. 19 and 20 will assist the reader in following the line of reasoning pursued.

In the first place, the total tensile stress on the metal in width b is

$$P_s = \frac{Fa^2b}{d} ;$$

when the unit strain or extension of the metal is

$$\lambda_2 = \frac{F}{E_s},$$

and

$$P_s = E_s \lambda_2 \frac{a^2b}{d}.$$

Taking next the compression side, the unit strain of the concrete is

$$\lambda_1 = \lambda_2 \frac{y_1}{y_2},$$

with the following resulting stresses :—

$$f_c = \lambda_1 \frac{2E_c}{3} = \lambda_2 \frac{y_1}{y_2} \frac{2E_c}{3} \text{ for stone concrete ;}$$

and

$$f_c = \lambda_1 \frac{E_c}{2} = \lambda_2 \frac{y_1}{y_2} \frac{E_c}{2} \text{ for cinder concrete.}$$

The total stress on the concrete in width b is

$$P_c = \frac{5 f_c\, b\, y_1}{8} \text{ for both stone and cinder concretes.}$$

Then

$$P_c = \frac{5b\, y_1^2 \lambda_2 E_c}{12 y_2} \text{ for stone concrete,}$$

and

$$P = \frac{5b\, y_1^2 \lambda_2 E_c}{16 y_2} \text{ for cinder concrete.}$$

As, however, $P_c = P_s$, it follows for stone concrete that

$$E_s \lambda_2 \frac{a^2b}{d} = \frac{5b\, y_1^2 \lambda_2 E_c}{12 y_2} ;$$

whence

$$y_1^2 = \frac{12 a^2 y_2 E_s}{5 d E_c} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Similarly, for cinder concrete it follows that

$$E_s \lambda_2 \frac{a^2b}{d} = \frac{5b\, y_1^2 \lambda_2 E_c}{16 y_2}$$

whence

$$y_1^2 = \frac{16 a^2 y_2 E_s}{5 d E_c} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

In computing the moments of ultimate resistance of the cross-section, the axis of compression is taken by Mr. Johnson in the position that it would occupy if the shaded area in Fig. 20 were a triangle. Although not precisely accurate this assumed position leads to no appreciable error.

The result is that for the moment of resistance for failure in tension

$$M_0 = P_s y_2 + \frac{2P_c y_1}{3}$$
$$= \frac{P_s}{3}(3y_2 + 2y_1)$$
$$= \frac{Fa^2b}{3d}(3y_2 + 2y_1) \quad \ldots\ldots\ldots\ldots (3)$$

and for the moment of resistance for failure in compression,

$$M_0^1 = P_s y_2 + \frac{2P_c y_1}{3}$$
$$= \frac{P_c}{3}(3y_2 + 2y_1)$$
$$= \frac{5bf_c y_1}{24}(3y_2 + 2y_1) \quad \ldots\ldots\ldots\ldots (4)$$

The total depth of the beam is

$$t = y_1 + y_2 + e \quad \ldots\ldots\ldots\ldots (5)$$

The distance represented by e can, of course, be varied by the designer according to the thickness and character of the metal employed, and to the position and intended purpose of the construction. In using the formulas (3) and (4) the smaller of the two values for the moment of resistance should be employed, but in designs where the quantity of metal can be varied, it is always desirable that the construction should be of equal strength in tension and compression, so that $M_o = M_o^1$, or that,

$$\frac{Fa^2b}{3d} = \frac{5bf_c y_1}{24}$$

From this equation is obtained the amount of metal in square inches per inch in width of the beam, or

$$\frac{a^2}{d} = \frac{f_c y_1}{1{\cdot}6\, F} \quad \ldots\ldots\ldots\ldots (6)$$

The combination of formulæ (1) and (6) gives

$$y_2 = \frac{2\, F\, E_c\, y_1}{3 f_c E_s} \text{ for stone concrete } \ldots\ldots\ldots (7)$$

and the combination of formulæ (2) and (6) gives

$$y_2 = \frac{F\, E_c\, y_1}{2\, f_c\, E_s} \text{ for cinder concrete } \ldots\ldots\ldots (8)$$

These values introduced into formula (4) give for stone concrete

$$M_0^1 = M_0 = \left[\frac{5\, b\, F\, E_c}{12\, E_s} + \frac{5\, bf_c}{12}\right] y_1^2 \quad \ldots\ldots (9)$$

and for cinder concrete

$$M_0^1 = M_0 = \left[\frac{5\, b\, F\, E_c}{16\, E_s} + \frac{5\, bf_c}{12}\right] y_1^2 \quad \ldots\ldots (10)$$

If it be desired to adjust the moment of resistance of a beam so that it may be equal to a predetermined bending moment we have $M_0^1 = M$ and from (9) for stone concrete

$$y_1 = \pm \sqrt{\frac{M}{\frac{5\, b\, F\, E_c}{12\, E_s} + \frac{5\, bf_c}{12}}} \quad \ldots\ldots\ldots (11)$$

and from (10) for cinder concrete

$$y_1 = \pm \sqrt{\frac{M}{\frac{5\, b\, F\, E_c}{16\, E_s} + \frac{5\, bf_c}{12}}} \quad \ldots\ldots\ldots (12)$$

The foregoing equations can be considerably simplified for general use when the physical properties of the reinforcement and the concrete have been settled, and in the case of (11) and (12) the factors are readily reducible to numerical fractions. In using the formulæ for beams of equal strength above and below the neutral axis, the value of y_1 is determined from (11) or (12) ; y_2 from (7) or (8) ; and $\frac{a^2}{d}$ from (6).

The thickness of the concrete and the spacing of the bars then depends upon the size of the bars used.

Let us assume F, the elastic limit of the steel to be used, at 54,000 lbs. per square inch ; E_c, the co-efficient of elasticity of concrete, at two-thirds the original value, or, say $\frac{2}{3} \times$

3,000,000 lbs. = 2,000,000 lbs. per square inch; and f_c the compressive strength of the stone concrete adopted, at 2,400 lbs. per square inch.

Then formula (11) for stone concrete may be reduced thus—

$$y_1 = \pm \sqrt{\frac{M}{\frac{5b \times 54,000 \times 2,000,000}{12 \times 30,000,000} + \frac{5b \times 2,400}{12}}}$$

$$= \pm \sqrt{\frac{M}{(b \times 1,500) + (b \times 1,000)}} \quad \ldots\ldots\ldots\ldots (11a)$$

For the purpose of illustration we will apply this formula to the case of a beam 8 inches wide, supported at each end with a clear span of 80 inches, and subjected to a concentrated centre load of 10,000 lbs.

We then have $b = 8$ inches, and for the bending moment

$$M = \frac{Wl}{4} = \frac{10,000 \times 80}{4} = 200,000 \text{ inch-lbs.}$$

Inserting these values in the formula we obtain

$$y_1 = \sqrt{\frac{200,000}{(8 \times 1,500) + (8 \times 1,000)}} = \sqrt{10} = 3{\cdot}16 \text{ ins.}$$

This is the distance of the extreme fibre in compression from the neutral axis as represented in Fig. 19.

To find the distance between the neutral axis and the centre of the reinforcement, y_2 Fig. 19 we use formula (7), and inserting the values stated above, and the value of y_1 it becomes

$$y_1 = \frac{2 \times 54,000 \times 2,000,000 \times 3{\cdot}16}{3 \times 2,400 \times 30,000,000} = 3{\cdot}16 \text{ ins.}$$

From formula (6) the amount of metal in square inches per inch in width is obtained. Thus

$$\frac{a^2}{d} = \frac{f_c\, y_1}{1{\cdot}6\, F} = \frac{2,400 \times 3{\cdot}16}{1{\cdot}6 \times 54,000} = 0{\cdot}0877 \text{ sq. ins.}$$

This is equal to a total area of steel reinforcement for the width b amounting to $8 \times 0{\cdot}0877 = 0{\cdot}7016$ square inch, and if we adopt a spacing of 2 inches there will be four bars, each with an area of $0{\cdot}7016 \div 4 = 0{\cdot}1754$ square inch.

The depth of concrete below the centre line of the reinforcement may be fixed at about 1·5 inch, or say 1·68 inch, which, by rule (5), will give for the total depth of the beam

$$t = y_1 + y_2 + e = 3{\cdot}16 + 3{\cdot}16 + 1{\cdot}68 = 8 \text{ ins}$$

Finally, the moment of ultimate resistance may be calculated by formula (9)

$$M_0 = M_0{}^1 = \left[\frac{5bFE_c}{12\,E_s} + \frac{5bf_c}{12}\right] y_1{}^2$$

$$= \left[\frac{5 \times 8 \times 54,000 \times 2,000,000}{12 \times 30,000,000} + \frac{5 \times 8 \times 2,400}{12}\right] \times 10$$

$$= [12,000 + 8,000] \times 10 = 200,000 \text{ in.-lbs.}$$

Therefore, the moment of resistance agrees with the stated bending moment.

The general result of the foregoing calculation indicates that 10,000 lbs. is the maximum centre load for a concrete-steel beam, 8 inches square, with a clear span of 80 inches, containing about 1.1 per cent. of steel reinforcements, and otherwise conforming with the stated conditions. Making due allowance for the relatively high elastic strength of the steel here considered, and also for the percentage and position of the reinforcement, this result is fairly in agreement with the records as to the ultimate strength of the beams of similar dimensions tested by Professor Hatt.

In using the foregoing formulæ any desired factor of safety may be applied at the discretion of the designer to suit the requirements of the work to be carried out.

COMPETITIONS.

PROPOSED CASINO, MADRID.—We have received the particulars of an international competition for a new casino, to be built at Madrid, at a cost of two million pesetas (about 40,000l.). Three premiums will be given, and designs are to be sent in by December 15. The pamphlet which has been sent to us gives no secretary's address, nor does it state clearly where the drawings are to be sent; apparently to the President of the Casino, Madrid, from whom we suppose that the instructions can be obtained. We do not, however, at all recommend English architects to compete, as we doubt if they will gain anything by doing so.

OBITUARY.

MR. RICHARDS.—We regret to learn that Mr. Edward Richards, of No. 7A, Strand, Torquay, died a few days ago, aged sixty-one years, from the results of an accident. Mr. Richards, who was architect and surveyor to the Haldon Manor estate, South Devonshire, had a good practice in Torquay and the neighbourhood. He prepared the plans and designs for the Cottage Hospital at Totnes, the Conservative club-house at Brixham, erected on a site adjoining the Market Hall, and his designs were selected in competition for a proposed pavilion and concert-rooms at Torquay, for which, however, the scheme was for some cause relinquished.

GENERAL BUILDING NEWS.

DAME MARGARET'S HOME, NEWCASTLE.—On Saturday afternoon last the newly-erected Memorial Cottage, situated at the south-east corner of the grounds of Dame Margaret's Home, Washington Hall, was formally opened in the presence of a fairly large assemblage of visitors, including Mr. Robt. K. Sinclair, London; Mr. and Mrs. James Sinclair, Newcastle; and others. The cottage, which is built of Birtley brick, with stone facings at doors and windows, is one story in height, and was designed by Mr. A. B. Plummer, architect, Newcastle. It contains two bedrooms, a sitting-room, nurses' room, a kitchen, bathroom, with necessary conveniences, and will accommodate twelve children. The contractor for the whole of the work was Mr. Hunter, Washington. The inscription at the front notifies that the cottage is erected to the memory of Robert and Isabella Sinclair, Newcastle, by their family.

NEW BUILDINGS, ABERDEEN.—The plans of the following buildings have been sanctioned by the Plans Committee of Aberdeen Town Council:—Six dwelling-houses on the south-west side of Hammerfield-avenue, for Mr. John Craigen, solicitor, per Messrs. Sutherland and Pirie, architects; dwelling-house on the north side of Belmont-road, for Mrs. Elizabeth Duthie, Powis-terrace, per Messrs. Cameron and Watt, architects; warehouse on the north side of Maberly-street, for Richards, Limited, manufacturers, per Mr. R. G. Wilson, architect; dwelling-house on the east side of Duthie-terrace, for Mr. James G. M'Donald, manager, per Mr. Wm. Davidson, architect, Ellon; four dwelling-houses on the south side of Victoria-road, for Messrs. Main, Robertson, and Ritchie, fishermen, and Mr. John Webster, fishcurer, per Mr. John Milne, architect; four dwelling-houses on the north side of Cedar-place, for Mr. Alexander A. Smith, house proprietor, Elgin, per Mr. Harvey Mennie, architect; dwelling-house on the south west side of Broomhill-avenue, for Mr. John S. Stuart, accountant, per Messrs. Sutherland and Pirie, architects; four dwelling-houses on the north side of Carlton-place, for Mr. T. W. Hector, solicitor, per Mr. James Scott, jun., joiner; dwelling-house on the east side of Burns-road, for Mr. Wm. Leith, cycle agent, per Mr. Thomas Reid, Bieldside; dwelling-house on the north-west side of Erskine-street, for Mr. Sylvester Strachan, contractor, per Messrs. Sutherland and Pirie, architects.

NEW MASONIC HALL, HEATON.—A block of buildings, comprising a Masonic Hall, four shops, a restaurant, assembly-room for dances, banquets, receptions, and hall for Freemasons' lodges, together with caretaker's rooms, has been erected at Heaton. The building has its chief front in Shields-road, with an entrance, and extends for a distance into Edwin-street. The building comprises five stories, the shops being situate on the ground floor, with the Masonic Hall, etc., above, and the cafe restaurant and billiard saloon in the basement. The rooms are elaborately furnished throughout. Messrs. Farthing and Dunn, of Newcastle, were the architects, and the general contractor was Mr. Thomas Weatheritt, Newcastle. The decorations were carried out by Mr. T. S. Butterwick, Newcastle, and the electric light was installed by Messrs. P. G. Hazelhurst and Co., also of that city. An improved system of ventilation was introduced by Messrs. Stott, of Newcastle and Wolverhampton; the furnishings were supplied by Mr. L. H. Gullachsen, of that city; the lifts by Messrs. Waygood and Otis, London; the parquet floor, with a sub-floor of springs, in the ballroom by Messrs. Waring and Gillow, Lancaster and London; the plumbing by Mr. Stewart, Newcastle; and the heating arrangements by Messrs. Hastie and Duncan, also of that city.

NEW REFORMED PRESBYTERIAN CHURCH, BELFAST.—A new Reformed Presbyterian church, situated in Cregagh-road, Belfast, was recently opened. The new building, which has been erected at a cost of 1,250l., includes a lecture hall on ground floor and a church above. It faces Cregagh-street. The outside dimensions are 56 ft. by 36 ft. On entering the building, the door of the lecture hall is opposite, with the stairs on either side leading up to the church. The dimensions of the lecture hall are 44 ft. by 34 ft. by 14 ft. high. It is ceiled diagonally in panels with yellow pine and varnished. The wainscotting also is of yellow pine varnished, and rises to the height of window sills. At one end is a platform, 22 ft. by 7 ft. by 1 ft. 3 in. high. Off this hall are the lavatories, heating chamber, etc. These can be approached also from without by a side door. There are two sets of stairs leading to the church, each consisting of two flights. They are of pitch pine throughout, with mahogany hand rails and 6 in. newels. At top of stairs is the vestibule, from which the church is approached by two doors leading into either aisle. The floor of the church is supported by two 15in. by 12in. pitch pine beams, which project into the lecture hall below, and are supported in the centre by 7 in. columns (cast iron). On these beams are the joists, 11 in. by 2 in., every third joist being 11 in. by 3 in., carrying 1¼ in. flooring. The church is of the same dimensions as the lecture hall; but the ceiling is coved at the beam, which gives it a greater height (24 ft.). The ceiling is ceiled with pitch pine sheeting, panelled diagonally and varnished. Part of roof trusses show through this. The wainscotting also is of pitch pine, 4 ft. high, and varnished. The pulpit is of platform style, and is entered at one side alone. The pulpit is panelled. It is square, with a three-sided projection in front. On the centre panel is the book bracket. In front of the pulpit is the choir seat. The whole seating, with pulpit, is of pitch pine varnished. The aisles are 3 ft. 6 in. broad, and carpeted. The church has a seating accommodation of 260 adults. The entire building is lighted with incandescent light, and is heated on the high pressure system with small pipes. The heating apparatus was supplied by the Ravenhill Iron Company; Mr. R. Hewitt, Ballyhackamore, Belfast, was the builder; and the architect is Mr. Jas. Scott, Annadale-avenue, Belfast.

NURSES' HOME, BIRKENHEAD BOROUGH HOSPITAL.—The Nurses' Home built in connexion with the Borough Hospital was recently opened. The Home has been erected on land adjacent to the hospital which was purchased a year or two ago from the Corporation of Birkenhead. The building, which fronts Livingstone-street, is L-shaped in plan, and consists of ground and first floors. It contains on the ground floor entrance porch and vestibule, with lavatory, etc., off same, dining hall, nurses' day room, head nurse's room, and nine bedrooms for nurses, access to these being obtained from a spacious and well-lighted corridor, at one end of which is placed the sanitary tower, containing bath-room, housemaid's sink, etc. At the back of the dining hall are the usual administrative offices, including still-room, store-room, and pantry. The first floor contains a nurses' sitting-room, ten bedrooms for nurses, and a large bedroom for servants, the sanitary tower being directly above that on the ground floor, and is similarly fitted up. Ample provision is also made on this floor for stores and linen. Special provision has been made for egress in case of fire. The dining-hall and day-room on ground floor are convertible, if required, into one room by means of a folding partition, these two rooms being dedicated to the memory of the late Mr. William Laird. The building is lighted throughout by electricity, and special attention has been given to the sanitary fittings, drainage, and ventilation. Externally the buildings are faced with grey bricks, relieved by red Ruabon moulded brick strings and bands. The contract for the building has been entrusted to Mr. Peter Rothwell, of Birkenhead, and that for the oak-work in connexion with the dining-hall and day-room to Messrs. Waring and Gillow, of Liverpool, the whole being carried out from the drawings prepared by and under the superintendence of Mr. Edmund Kirby, architect, of Liverpool.

NEW BANKING PREMISES, BELFAST.—A new branch has been erected for the Ulster Banking Company. The new premises are situated on a site at the corner of Shankill-road and Agnes-street, having a frontage to both south and west of 50 ft. The elevations are built of white Giffneuk stone and compressed bricks, with a base course up to the ground-floor windows of Aberdeen granite from whence up to the first-floor windows it is entirely composed of ashlar. The next two stories are carried out in compressed bricks, with stone dressings. The banking hall, which is 46 ft. long by 21 ft. wide, is entered through a mahogany-panelled porch, with swing-doors to match, the entrance door being of dark oak, handsomely panelled. The ceiling is 14 ft. high, and is divided into panels by projecting beams, each of which rests on two ornamental and enriched trusses at each side; the wide cornice returning round the beams, and below which is a deep-raised frieze. The manager's office, which is panelled in polished mahogany, as are also the counter, fittings, desk, etc., is situated at the opposite end from the porch, and is screened off from the banking hall by mahogany framing panelled

to correspond, the upper portion being filled with leaded glass. The counter, which is about 30 ft. long, extends from this to the porch, the front being divided into panels with raised mouldings, by projecting pilasters rising from the skirtings, and terminating under the counter-top, with carved trusses, and ornamented between with raised panels and mouldings. The space for the public is laid with a design in encaustic tiles, by Messrs. Craven, Dunnil, and Co., and the portion at the rear of the counter and manager's office is laid with pitch pine parquet flooring, by Messrs. Ebner. The strong-room is situated at the rear of the office, the interior being lined throughout with white glazed bricks and divided in the centre by a wrought-iron grille. The entire bank is heated by Messrs. Musgrave and Co.'s high-pressure hot-water system, and lighted throughout by electricity, which was carried out by Mr. Stanley Johnston, who also supplied the electric fittings. The whole of the manager's residence is situated over the offices, with the exception of the kitchen, which is on the ground floor. The office fittings were supplied by Mr. Mitchell, of North-street; the wrought-iron work by Mr. William Greer, of Great George's-street, and Mr. Jones, of York-street. The contractors for the building were Messrs. Courtney and Co., who have carried out the work under the superintendence of the architects, Messrs. Blackwood and Jury, Belfast.

METHODIST CHURCH, SUTTON, BELFAST.—The foundation-stones of a Methodist church, to be erected at Sutton, Belfast, were recently laid. The new church will provide seating accommodation for 300 persons, and will be erected at a cost of 1,130*l.* The scheme, when completed, will also include a school-house, manse, and church parlour. Mr. James Beckett is the builder, the architect being Mr. George Beckett.

CHURCH, SHOTLEY BRIDGE.—The church of St. John, Shotley Bridge, has been re-opened after the rebuilding of the chancel at the expense of Mr. I. W. Walton-Wilson, of Shotley Hall, Northumberland. The chancel has an open roof, and the east end is terminated by a pentagonal apse containing five single light windows. The organ chamber has been built on the north side of the nave, with the vestry behind. The old vestry has been removed, as well as the entrance lobby, in which stood the font, and the space added to the church, so that baptisms may be in sight of the congregation. The five single windows of the apse have been painted by Messrs. Bell and Beckham, of London. They contain figures of two Apostles, Saints John and Thomas, and of St. Lucy and the Virgin Mary, standing on bases and under canopies. Each figure bears its emblem—St. John the poisoned chalice, St. Thomas the builder's rule, St. Lucy the lighted lamp, and the Virgin Mary the lily. The centre light contains the figure of our Lord enthroned. The chancel has been built from the designs of Mr. Walton-Wilson, the stained glass and carved oak reredos having been executed under the direction of Mr. E. R. Robson, architect, of Westminster.

BAPTIST CHURCH AND SCHOOLS, BRIGHTON.—The memorial-stones of this building were laid on September 16 last. The building is to be faced with whole white flints, with red dressings. The seating to be in Orham wood, wax polished. Lead lights to all windows. Heating by low-pressure hot-water pipes and radiators. Electric light fittings of wrought iron and copper. Ventilation by means of an electric fan. The baptistry is to be lined with white marble. The accommodation will be for 443 adults on ground floor, 282 in galleries, total 725, or a mixed congregation of over 800 persons. The seating is arranged on a semi-circular plan, each hearer directly facing the minister. The schools are under the church, and will contain accommodation for about 500 scholars in a large schoolroom, infants' room, church parlour, and four class-rooms, with kitchen, etc. The architects are Messrs. George Baines and R. Palmer Baines, of London. The builders are Messrs. Batley, Sons, and Holness, also of London. The present contract is for 5,381*l.*, exclusive of galleries (except choir gallery).

WORKMEN'S DWELLINGS.—Considerable improvements continue to be made in many districts in the houses of the working classes, says Dr. Hill, Medical Officer for the County of Durham, in his Report for 1902. Old dwellings, consisting of one rooms downstairs and an ill-ventilated attic, are in some parts of the county being rapidly replaced by more commodious dwellings. In some of the older colliery districts there is still, however, much need for improvement in the dwellings of many of the inhabitants. It is considered that it is most important that not only should all back-to-back houses be abolished, but that every dwelling should have adequate bedroom accommodation separate from the day-room or kitchen. In Hartlepool, Consett, Hebburn, and Spennymoor, and in the Auckland, Chester-le-Street, and Houghton rural districts, a large number of insanitary dwellings are reported to exist, which require to be dealt with under the Housing of the Working Classes Act. The sanitary authorities have difficulty in enforcing that Act, owing to the great overcrowding of dwellings already prevailing in these districts, which would be aggravated by the closing of the insanitary dwellings.

PROPOSED KURSAAL AT WHITLEY BAY.—A meeting of tradesmen was held on the 10th inst. to consider the proposed Kursaal, which it is intended to build adjacent to Whitley Links. There was a large attendance. The Chairman explained that the object of the meeting was to consider the proposal of the promoters of the Kursaal that they should have exclusive use of the bandstand on the Links at the same terms which are at present paid by the pierrots, as, in their opinion, the presence of such entertainments in front of their building would be detrimental to the success of the scheme. After an animated discussion, it was decided that Messrs. Forbes, Wedderburn, R. H. Armstrong, and Menzies be appointed to wait on the Council and express the opinion of the meeting that, while every encouragement should be given to the promoters, they will see that provision is made elsewhere on the Links for open-air entertainments.

CHURCH HALL, WALLSEND.—In spite of the unfavourable weather, there was a numerous assemblage on the 10th inst. at the ceremony of laying a corner-stone in a new parochial hall at Wallsend. The ceremony was performed by Lord Armstrong, who delivered an address. The hall is situated in Durham-street, and is in connexion with St. Peter's Parish Church, of which the Rev. Canon Henderson is rector. There will be sitting accommodation for 500 persons. On one side will be a number of class-rooms, and an institute, with reading and billiard-rooms, will be attached, together with sitting-rooms, vestry, and accommodation for the caretaker. The total cost will be about 2,600*l.*, of which nearly 1,000*l.* has been received or promised. The architect for the hall is Mr. B. F. Simpson, of Newcastle, and the contractor is Mr. John Potts, of Wallsend. The site was given by Mr. R. R. Dees.

HIGH LEVEL BRIDGE, NEWCASTLE-ON-TYNE.—On the 10th inst., some members of the Newcastle Association of Engineers visited the works of the new high level bridge the North-Eastern Railway Company are building across the river Tyne. At the same time, the unpleasant weather did not divest the occasion of either its interesting or informative character, for the making of the new bridge is an enterprise of such magnitude and skill as to be attractive to most people, whether they be engineers or not. The viaduct, which is to link the main railway lines on both sides of the Tyne in a more direct fashion than hitherto, and so relieve the increasing congestion of traffic on the present High Level Bridge, has been described in detail on several occasions. That it is to be some 1,500 ft. in length; that it will be a steel girder bridge supported on many arches and four piers—three of which are to be founded in the river bed; that it will cost half a million pounds; that it constitutes the biggest bridge contract since the erection of the Forth Bridge; and that it is anticipated it will lead to a saving of 20,000*l.* a year in locomotive power when it is finished, are all statements which have a ring of familiarity about them. What is perhaps more to the point is the progress made with the undertaking, and that the engineer students had the opportunity of seeing, under the guidance of Mr. Charles Harrison, the designer of the bridge and chief engineer of the North-Eastern Railway; Mr. C. F. Dixon, managing director of the Cleveland Bridge and Engineering Company—the constructors of the bridge; Mr. F. W. Davis, another director of the company; and Mr. C. R. S. Kirkpatrick. The latter are the builders' resident representatives. The visitors started from the north side, where the piers to carry the girders through the Forth Goods Warehouses are up practically to the level of the girder beds. The cellars of the warehouse had to be underpinned, and this little bit of business consumed five million bricks—all within the narrow space bounded by the Carlisle line and the south wall of the warehouse. Preparations are going on now for taking down the necessary portion of the warehouse south wall, which is on the site of the abutment for the Pottery-lane approach. From Pottery-lane down to the land abutment—which is on the verge of the slope to the river edge—the ten arches required have been finished up to the top. As to the north pier in the river, the temporary staging for constructing and dealing with the caisson that plays so important a part in the foundation work has been begun. So far as the centre pier is concerned, the staging is up, and the huge steel caisson—113 ft. by 35 ft., and having a shape which has been not inaptly described as that of an inverted pie-dish—is being constructed. It is to be sunk to a depth of 69 ft below high-water level. That for the south pier foundation has already been sunk 59 ft. below high-water mark, and it is progressing downwards, through the operations of the excavators who work in its ingenious air chambers, its own cutting powers, and the assistance of hydraulic jacks, about 10 in. a day. Each caisson will weigh about 500 tons, but the pressure of compressed air in the working places tends to keep it buoyant, and so its progress to the bed rock of the river is aided by filling it with concrete. The south caisson at the present time contains 7,500 tons of this compound, and when it has advanced sufficiently it will be completely filled with cement concrete, on the top of which the granite pier is to rise 83 ft. That process will, of course, be adopted in the case of the other pair of caissons. Originally there were to have been eight arches on the Gateshead side, but four are to be substituted by a pier. The discovery of faulty strata has led to this modification. Then, too, some very ancient coal workings—supposed to be of Roman origin—were found, though they were not disclosed by the borings first taken. However, they had to be dealt with, and something like 700,000 bricks put in to make things secure. That fact accounts for the delay there has been in raising outward signs of the work on the south bank of the Tyne. All the same, very valuable labour has been going on, and some of the arches are beginning to receive attention now. A novelty for Tyneside will be supplied by the contractors in the shape of a transporter cable railway with 1,520 ft. span. This will be supported on two towers, on opposite shores of the river, each 120 ft. high. The main cable, which weighs 10 tons, and is to carry 10 tons weight in the centre, is being made by Messrs. T. and W. Smith, Newcastle. When loaded the cable, which will be used for sending out materials to the river piers, will sag 75 ft. out of the horizontal. Next week the building of the towers will be started.

LIVERPOOL.—The Harbreck Estate at Fazakerley, on which the Corporation are building a hospital at a cost of 130,000*l.*, is perhaps one of the most interesting in the vicinity of Liverpool. A mansion on the grounds, which has been considerably extended in order to form an administrative department for the smallpox pavilions already existing, was long in the occupancy of the family to which Mr. Justice Walton belongs. There are still a spacious kitchen garden and a vinery. The garden is enclosed by high walls, which are covered with neatly trained and trimmed fruit trees; and, for the purpose of bringing the products of these to perfection, hot-water pipes are embedded in the walls. A complete change has been effected on the land attached to the institution in Mill-road, Old Swan.

COTTAGE HOMES, PONTELAND.—The opening of the new cottage homes erected at Ponteland by the Board of Guardians of the Newcastle Union was fixed to take place on the 17th inst. At 3 o'clock in the afternoon the guests were received at the entrance gates. The opening ceremony was afterwards performed in the schoolroom.

SANITARY AND ENGINEERING NEWS.

FORESHORE WORKS, SANDOWN, I.W.—The Works Committee recommended that the surveyor should be instructed to prepare plans and estimates for raising the Herne Hill groin level from the existing break in the height and for lengthening it either 25 or 50 yards.—The Chairman said the first intimation they had that it would be a benefit to raise the groin was when they heard about the Board of Trade making an order prohibiting the removal of sand from the shore. The impression in the town was that members wished to make the groin higher so as to collect more sand on the shore for builders to remove. It could not be contradicted that the shore was being very rapidly denuded of sand in certain places. One of the cries on which some members came to the Council was that of economy. Nobody had raised a question as to the inefficiency of the groin.—Mr. F. Colenutt argued that the groin had saved considerable expense in repairs to the Esplanade, which but for it would have been down. It was not quite safe even now, and he had always advocated carrying the groin further to sea. When the wind blew sand now went round the end of the groin by tons. It would be an advantage to lay out money there. The town got the benefit of the work done by the builders and of the material for making blocks. If the builders had to pay more for sand and shingle they would have to charge more for it.—The Chairman proposed the rejection of this recommendation, but it was not seconded.—Mr. Duff said if the builders used the material for houses they were mortgaged to the town as soon as built.—The recommendation was then adopted. —*Isle of Wight County Press.*

THE LONDON WATER SUPPLY.—From the recently published report on the metropolitan water supply, it is evident that the Thames water at the three intakes in the Hampton district was in good condition throughout the whole

of the month of July. The average daily supply delivered from the Thames was 133,513,576 gallons; from the Lea, 47,115,216 gallons; from various springs and wells, 58,417,329 gallons; and from the ponds at Hampstead and Highgate 261,438 gallons, the latter being used for non-domestic purposes only. Estimating the population at 6,522,642, the daily consumption per head amounted to 36.69 gallons for all purposes. It is satisfactory to observe from the results of analysis that supplies furnished by the Southwark, Grand Junction, and Lambeth water companies contained smaller percentages of organic impurity than were present in June. Of supplies largely obtained from the River Lea, that of the New River company was clear, and contained only a small amount of organic matter; while that of the East London company was clear and of good quality, containing a smaller proportion of organic impurity than in June. The deep-well water furnished by the Kent company was perfectly clear and of high organic purity. As might be expected, the heavy rainfall of the month unfavourably affected the condition of the Thames for the operations of the companies deriving supplies therefrom, and the proportions of organic impurity were somewhat higher than are ordinarily found during the summer months. In the case of some companies, small amounts of suspended matters were occasionally present, these consisting chiefly of rust-stained particles, sometimes accompanied with diatoms and other minute organisms. On the whole, however, it appears to be clear that the metropolitan water supply was by no means in an unsatisfactory condition during the month in question.

FOREIGN.

FRANCE.—The municipality of Neuilly has lately organised a competition among the gardeners of the locality, premiums being given the most beautifully kept and laid-out gardens. ——A new Mairie, from the designs of M. Langlois, has been opened at Orly.——The remains of a Gallo-Roman villa, decorated with fresco, have been discovered in the neighbourhood of St. Flour.——The Government has scheduled among Monuments Historiques a small fort at Camaret (Finistère), which was constructed by Vauban.——M. Virello has been appointed the architect to carry out some important alterations to the municipal Casino at Nice.——A large lunatic asylum is to be built in the Department of Saône-et-Loire.——The jury in the competition opened by the municipality of Limoges for a new Circus has awarded the execution of the work to M. Emile Robert, of Clamart; and the second premium to M. Deperthes (Paris).——The authorities of Auxerre have opened a competition for a new savings-bank building.——M. Kruger, the City Architect of Montpellier, has been commissioned to carry out a new lycée at an estimated cost of 2 million francs.——The Musée des Monuments Historiques at Mans has been opened. It occupies the crypt of the ancient chapel of the Comtes des Mans, which has been carefully restored.——A statue to Berlioz has been erected at Grenoble; the sculptor is M. Urbain Basset.——At Lille all the fortifications are to be demolished between the Porte d'Ypres and the Porte Louis XIV., in order to enlarge various barracks, the general hospital, and the railway station.——The "Autumn Salon" is to open at the end of October, in the ground-floor galleries of the Petit Palais.——M. Jules Pray has been appointed architecte-en-chef to the Prefecture of Police, in place of the late M. Bunel. M. Pray already held an important place in the service of the Prefecture.——A monument to Renan was inaugurated last Sunday at Tréguier. It is the work of M. Jean Boucher, whose fine group, "Antique et Moderne," was published in the *Builder* of July 15, 1899. Renan is represented seated, in a meditative attitude, on a stone bench. Behind him is a figure of Pallas holding above his head a branch of laurel. The pedestal, in green Kersanton granite, has been designed by M. Nénot.——An old house at Alençon, known under the name of "Maison d'Ozé," has been scheduled among Monuments Historiques.——The Municipal Council of Cherbourg has decided on undertaking some important operations with the object of bringing into the town the waters from the spring in the valley of Cherbourg, to replace the supply from the waters of the Divette. The cost of the work is estimated at 2,600,000 francs.——M. Berlier, the engineer, has submitted to the Municipal Council of Lyons a scheme for a city railway which will cross the Rhone twice, starting from and returning to the Gare de Perrache.——We have to record the death of M. Hector Riondel, architect, of Grenoble, a former pupil of Questel, with whom he worked in the carrying out of the Grenoble Museum. He took part also, under M. Daumet, in the building of the Palais des Facultés, and carried out the restoration of the Palais de Justice at Grenoble. M. Riondel carried out a good many buildings in the Department of the Hautes Alpes, and was the founder of the architectural societies of Dauphiné and Savoy, of which he was at one time President. He had been for twenty years a member of the Société Centrale des Architectes. ——The death is announced also of the following French painters: Louis Auguin, landscape-painter a pupil of Cogniet and Corot, who died at Bordeaux at the age of 79; Paul Gaugain, landscape-painter (at Tahiti, aged 52): Charles Klein (at Lunéville); and Alphonse Montluçon, flower-painter (aged 42).

MISCELLANEOUS.

RECLAMATION WORKS IN THE IONIAN ISLANDS.—Dr. Napoleon Zambelli, a distinguished lawyer, and one of the principal inhabitants of Corfu, died a few years back, and bequeathed a sum of 20,000*l.* for the purpose of draining several small lakes and swamps in the vicinity of the town, and also nominated a committee to carry out his wishes. It was decided to commence the work at lakes Krevatsoula and the Val di Ropa, the former to cost 1,000*l.* and the latter 5,000*l.*, the original idea being to reclaim 25 acres at Krevatsoula and about 1,500 acres at the Val di Ropa, besides considerably larger areas which from an agricultural point of view would, it was hoped, be rendered more fit for cultivation. The work was greatly delayed owing to rainy seasons, but it is now considered probable that it will be completed before another year is entered upon. Mr. Frederick Simmons is the resident chief engineer of Zambelli's Trust, and he reports progress up to date as follows:—At the Val di Ropa, which is the largest plain in the island, the work of draining is completely finished, only a masonry bridge remaining to be built to carry an important highway over the canal. The drainage of this pestilential swamp is perfect, and has considerably improved the climate of the surrounding country. No single case of malarial fever has appeared as yet this year in the many villages in the vicinity, whereas for many years past the suffering has been great. By this work about ten square miles of good land has been made available for cultivation; about half of this is splendid land for cotton growing, and the remainder for cereals. I have reason to believe that there is a scheme in Corfu for cotton cultivation at this place. This business, if properly managed, is bound to be successful, and would employ a great deal of labour. Altogether about 28 miles of canals have been made at the Val di Ropa for drainage purposes, and, to connect the land cut up by the canals, 29 bridges of iron and stone have been constructed, besides basins for cattle to drink at, and masonry work of other descriptions. Ropilla Basin, situated about one hour's drive from Corfu on the Val di Ropa road, consists of six distinct swamps, all highly dangerous to health. Work is now proceeding at these swamps, and will, I estimate, be finished at the close of the present year (1903). There is no outlet to the sea at any of these places, and the drainage is difficult on that account; but by boring into the surrounding hills I have been fortunate enough to discover natural fissures in the rock, called in Greek Katavothras, into which the water will be led by canals. The drainage of this basin will free a large area of land for cultivation, and improve the general conditions of health. The Krevatsoula (Govino) swamp has proved very difficult to drain, on account of its small elevation above the sea. When the water was let off last year the whole area of the bottom sank some two feet. This has made it necessary to fill it in with earth, and this work is being now proceeded with, and will be finished probably in October. This earth covering will not prevent malarial exhalations for a year or two yet, so the local climate will not be entirely free from fever for that period. The land is favourable for cotton cultivation.

THE "HISTORICAL ENGLISH DICTIONARY" MEMORIAL.—The setting up of a memorial in honour of the labours of a lexicographer, however eminent, in his own life-time, is an event of rare occurrence. We are glad to hear, however, that Mr. T. E. Collcutt, who, we believe, is an "Old Mill-hillian," has made the plans and designs of a memorial that is being erected in the grounds of Mill Hill school, near Hendon, Middlesex. The memorial occupies the site of the original scriptorium in which Dr. Murray, of Oxford, when a master in the school, applied himself to the inception and first beginnings of the New (Historical) English Dictionary.

A NEW METHOD OF JOINTING AND SUPPORTING TRAMRAILS.—In ordinary practice some form of the well-known fish-plate joint is adopted for tramway rails, but electrically-welded joints are now being introduced with satisfactory results in Leeds and elsewhere. With either type of joint the use of tie-bars is necessary to preserve uniformity of gauge, and considerable care has to be taken to prevent the lateral movement which is so detrimental to the life of the rails, besides tending to cause the displacement of street paving. The method to which we now direct attention has been patented by Messrs. W. C. Sample and W. R. Binney, both of whom are members of the City Surveyor's staff, Sheffield, and have had considerable experience in laying out tramway rails in that city. The system may be thus described:—A transverse girder carrying two plates passes across the under side of the tram rails at every joint and at an intermediate point in each length of rail. The plates in turn support and are secured to the tram rails at the joints, and also at the centre of the rails, which may be of any length and laid to any required gauge. The plates on the transverse girders are bolted or rivetted thereto before delivery on the site of the works. The necessary bolt or rivet holes are drilled or punched in the plates, girders, and tram rails in their correct positions at the maker's yard, so that no drilling of holes on the site of the works need be necessary. In double junctions and on curves, where the joints of the tram rails do not come opposite one another, each transverse girder need not be longer than may be requisite to provide for a double rail joint, or for one joint only. Similarly, when the plates have to support points as well as rails, they may be varied in shape and size, and the transverse girder may be arranged to carry more than two plates. As the girders are of I-section they are of great rigidity, and afford a secure support for the rails, both at the joints and at intermediate positions. The girders are embedded in concrete in the bed of the track, and it is believed by the patentees that their system will tend to remove some of the practical difficulties connected with permanent way construction.

LONDON UNITED ELECTRIC TRAMWAYS.—Important as the existing developments of electric tramways in the west of London may be, the extensions authorised and proposed will have a much greater influence upon the traffic facilities in the metropolitan district. As our readers are aware, the sections of the system already open for traffic include the lines between Shepherd's Bush and Southall; Shepherd's Bush and Hounslow; Shepherd's Bush and Twickenham, Hampton, and Hampton Court Palace; Hammersmith Broadway and Hounslow; Hammersmith and Twickenham, Hampton, and Hampton Court Palace; Richmond Bridge and Twickenham; Teddington, Kingston Bridge, and Hampton Court Palace; and Kew Bridge and Richmond. The authorised extensions include lines from Acton to Willesden; Southall to Uxbridge; Hammersmith to East Acton; Richmond to Hammersmith Bridge, via Barnes and Mortlake; Hounslow to Cranford; Hounslow to Kempton Park; Twickenham to Kempton Park; Hampton to Molesey, Thames Ditton, Surbiton, Talworth, and Hook; Kingston to Surbiton; Kingston to Kingston Hill; and Kingston to Tooting, via New Malden, Raynes Park, and Wimbledon. Further, it is proposed to continue the line from Cranford as far as Slough and Maidenhead, and the line from Hounslow to Staines and Virginia Water. Although the routes in question may not be altogether pleasing to residents in the districts named, they will undoubtedly be of immense service to the population of London as a whole, and will act as valuable feeders for the various branches of the Metropolitan District Railway, and the existing as well as projected electric subways, thereby affording direct means of communication between places which are at present connected by the most circuitous and inconvenient routes.

SOME ITALIAN IMPORTS AND EXPORTS.—The accounts of the port of Genoa, just published officially, show that in the year 1902, 11,668 tons of bricks and tiles were imported from the United Kingdom. On the other hand, 120 tons of worked marble and alabaster were exported from Genoa to the United Kingdom. At the port of Spezia the imports included 225 tons of firebrick and tiles from the United Kingdom, whilst the exports to the United Kingdom included 1,235 tons of marble, 638 tons of stone for building and paving, and 999 tons of terra-cotta tiles and hollow bricks. At the port of Savona the imports of bricks and tiles from the United Kingdom fell from 854 tons in 1901 to 427 tons in 1902, and this decline is attributed entirely to German competition. The exports from Savona included 1,695 tons of granite squared blocks to Gibraltar for use in some special buildings there.

ANTIQUARIAN DISCOVERY.—A prehistoric British barrow was opened recently at Martinstown, Dorset, under the supervision of Mr. St. George Gray, curator of the Taunton Museum. There were disclosed worked flints and several interments. In the centre of the barrow was found a large British urn inverted on a slab of stone, covering some cremated remains which had been wrapped in a rough material of cloth or rushes, the texture of the weaving being still

traceable. A quantity of other pottery was also unearthed. In another barrow close by have been found a vase and a bronze knife with a portion of a willow handle.

ST. THOMAS' CHURCH, PORTSMOUTH.—The parish church of St. Thomas, Portsmouth, which, owing to its condition, had some time since to be closed, has been inspected by Mr. Jackson, the diocesan architect, upon whose recommendation an extensive scheme of renovation is to be carried out. It is anticipated that the approximate cost will amount to upwards of 4,000*l*. The church, a portion of which was built in the twelfth century, possesses numerous features of historic interest, and in the chancel is a monument to George Villiers, Duke of Buckingham, who, in August, 1628, was assassinated at the entrance to a house in High-street, Portsmouth.

DISCOVERY OF CINERARY URNS.—A discovery of considerable interest has been made at Braintree in the course of excavating a field for building purposes. A workman's pickaxe came in contact with some pottery, about 2ft. below the surface, which proved to be two cinerary urns of great antiquity. One, which was unfortunately broken by the pickaxe, contained a quantity of fragmentary bones, undoubtedly human. This urn is of elongated form and unornamented. The second urn is globular in shape, and ornamented with ribbed bands, and bears an inscription which has yet to be deciphered. The second urn, which contained nothing, was taken out of the earth in an excellent state of preservation. In the absence of expert opinion, the period to which the urns belong is problematical. It is significant, however, that the spot from which they were taken is quite close to the supposed site of an ancient lake dwelling. —*The Times*.

ARCHITECTURAL EDUCATION IN LEEDS.—Following the example of Manchester and Liverpool, Leeds is making an endeavour to constitute itself a centre of architectural education. The movement is owing mainly to Mr. Butler Wilson, the present energetic president of the Leeds and Yorkshire Architectural Society. There are no funds at present to found a Chair of Architecture in Leeds, but a combined course of architectural studies has been framed by utilising the classes of existing institutions and making their teaching part of a system under the conduct of the Leeds and Yorkshire Architectural Society. Engineering subjects will be taught at the Yorkshire College, the preliminary course of design will be taken at the Leeds Institute, and the advanced course of design at the Architectural Society's rooms. A definite programme of studies has been made out, and classes are provided for the whole of the subjects included in the Institute of Architects' Intermediate Examination. The Leeds and Yorkshire Architectural Society and the architectural students of the district ought to feel grateful to Mr. Butler Wilson for the enlightened efforts which he has made to promote the study of architecture.

CAPITAL AND LABOUR.

NEWCASTLE BUILDERS' LABOURERS' WAGES.—A meeting of the Town Improvement Committee of Newcastle Corporation was held on the 9th inst. A deputation representing the Labourers' Union waited on the Committee with reference to the wages allowed to their members for demolishing houses on the Quayside for the purpose of widening that part of the city. At present the Corporation were paying 5¾d. per hour, whilst for similar work, it was declared, the Master Builders' Association of the city were paying 6¼d. per hour. On the other hand, the City Engineer intimated that he was informed 5¾d. per hour was the standard wages. It was decided by the Committee to make inquiries of the Builders' Association, and ascertain definitely what really was the amount paid by the members for the work.

SUNDERLAND JOINERS' DISPUTE.—At a conference of the Northern Centre of Building Trade Employers and the executive committees of the Amalgamated and the Associated Societies of Carpenters and Joiners held at Leeds, both parties agreed to ask the Board of Trade to nominate an arbitrator to adjudicate upon the Sunderland joiners' dispute.

LEGAL.

ANCIENT LIGHT DISPUTE, RICHMOND.

THE case of the London Property Investment Trust (Limited) v. the Corporation of Richmond and Gosling and Son came before Mr. Justice Bucknill, in the Vacation Court, on the 16th inst. on the application of the plaintiffs for an interim injunction to restrain the defendants from building so as to obstruct the plaintiffs' ancient lights. The case was reported in the issue of *The Builder* for September 12.

On the case being called on, his Lordship said he had read the papers, and should like to ask the learned counsel appearing for the plaintiffs what the urgency of the matter was.

Mr. Mulligan, K.C., in support of the motion, said that the defendants gave an undertaking last week not to build higher between then and that day. The matter was urgent. If his learned friend appearing for the defendants was willing to extend that undertaking till the trial, he was willing to allow the present motion to stand till the trial.

Mr. Bramwell Davis, K.C., for the defendants, said he had a complete answer to the plaintiffs' case. He wished, however, time to answer the plaintiffs' affidavits which had been filed, and suggested that the motion should stand over till next Wednesday.

His Lordship assented to this.

Mr. Bramwell Davis said that if his learned friend was right on the point of law which was raised there could be no doubt that there was some interference with the plaintiffs' light The defendants' case, however, was that the plaintiffs' lights were not ancient lights at all. Another point was that certain open spaces were Crown lands, and that plaintiffs could not get any rights to light as against the Crown.

His Lordship intimated that if the plaintiffs pressed on the application he would fix a special day for hearing the motion if need be.

AT Westminster, the London County Council recently proceeded by summons against Alfred Curphey, of 28, Victoria-street, Westminster, for erecting a building without first having obtained the approval of the central authority. Mr. Daldy was counsel for the L.C.C.; Mr. Lawless for the defendant. A temporary wooden structure was put up in June last at the rear of the defendant's premises to shelter a railway model with a system of automatic signalling. The defendant obtained the usual certificate from the Westminster City Council, but the County Council intervened and said that body was the authority in such matters. The defendant had written expressing his willingness to take out any licence that might be required, and stating that he had every desire to abide by the requirements of the Building Act. After consulting a cited case, his Worship dismissed the summons, with 10*l*. 10s. costs against the London County Council. Mr. Daldy asked for a case to be stated, and the magistrate agreed.

PATENTS OF THE WEEK.

APPLICATIONS PUBLISHED.*

25,548 of 1902.—J. PERRY: *Chimneys.*

A ventilator for use with chimneys and for other ventilating purposes, consisting of a rotating top having a vane at one side and an open mouth at the other, with an extension directed upwardly or downwardly inside the top, the mouth being directed always against the wind.

18,308 of 1902.—R. STANLEY: *Apparatus for Use in Connexion with the Manufacture of Sanitary and other like Pipes.*

This invention relates to the manufacture of sanitary pipes, cable conduits, or the like, moulded from plastic clay by an extrusion press, and it consists of apparatus for grooving the interior of the socket of the pipe for keying the cement at the junction of the pipes when being laid. For the purpose of forming these grooves in the socket, rings are employed inside the inner die ring of the socket die, said rings, according to one form of this invention, being continuous rings, or according to another being divided each into any convenient number of segments—from two upwards; which rings by suitable means are caused to be forced into the substance of the pipe socket which is still within the socket die from slots in the die ring. It is desirable that the pressure applied to the clay cylinder above should be released before this stage, such as by withdrawal of the catches holding up the table (if the latter has not yet descended). The operation of impressing the die rings into the pipe socket might, however, be performed either during the extrusion of the pipe or after the same.

18,607 of 1902.—A. MUSKER: *Hydraulic Machinery for Making Artificial Paving Slabs and similar Blocks.*

Machinery for manufacturing artificial paving slabs of cement, concrete, or the like, wherein the pressing of the concrete is effected by a hydraulic ram, the pressure water to the cylinder of which is directly forced by a pumping-engine; and wherein a revolving or reciprocating multiple mould or mould carrier is employed, the operating means of which, and the means for effecting the return stroke of said ram, or either of them, being operated by means separate from and other than said hydraulic service; whereby a rapid action and output is claimed to be obtained, and at the same time obviating the employment of an "accumulator" and "intensifier," or like hydraulic apparatus.

* All these applications are in the stage in which opposition to the grant of Patents upon them can be made.

19,307 of 1902.—F. RUSSELL: *Weather-casing Bricks.*

A brick for building in new walls or casing of old or new walls, made of any material for either outside or inside walls, with or without alternative dovetailings, notchings, and groovings to secure the adherence of mortar, with a specially-shaped base top and angle brick, and to be fixed with or without nails and with or without a projecting ledge for insertion in the mortar course of existing brickwork, to be built into or upon any wall with alternative top and finishing course and alternative provision for the angle pieces, to be made with or without closure pieces attached.

20,222 of 1902.—W. F. STANLEY: *Means for Fixing Stone Skirtings to the Walls of Buildings.*

The use in combination with stone skirtings for buildings of a metal tongue fitted into a groove made for its reception in the stone and screwed to a metal plate fixed in the wall behind, for the purpose of fixing the said stone skirtings.

22,546 of 1902.—G. DE LA PUENTE: *Apparatus for Raising Water.*

Apparatus for raising water by means of compressed air, consisting essentially of a submerged closed chamber containing a float, and provided with non-return water admission and water delivery valves, and means for the supply of air under pressure, in combination with a relief valve for the air adapted to be closed and opened by the rising and falling of the float.

22,734 of 1902.—H. K. G. BAMBER: *Manufacture of Portland Cement, and an Apparatus therefor.*

The object of this invention is to effect the more speedy evaporation of the water in the slurry and also to absorb the heat of and to cleanse the gases escaping from the rotary kiln, thereby economising fuel. According to this invention, the slurry is delivered in an atomised condition into the upper or drying end of the rotary kiln, where it comes in contact with the escaping gases, absorbing heat and cleansing them of coal dust or other suspended matter, which is thereby carried to the combustion end of the kiln. This may be accomplished by forcing the slurry through a tube, preferably water jacketed, at the end of which is a spreading nozzle, or the slurry as it is delivered from the tube may meet a jet or jets or air, or may be projected from a nozzle against a spreader.

22,805 of 1902.—O. HEISE: *Impregnation of Wood.*

A process for the uniform impregnation of wood with any desired quantity of tar oil, which consists in forcing the desired quantity of oil into the wood, and subsequently causing it to penetrate by the application of steam pressure.

23,286 of 1902.—L. SCHLENTHEIM and DIESPEKER, LTD.: *Wood Blocks for Flooring.*

A wood block for flooring, having inclined sides and ends each side and each end consisting of two planes inclined to one another (the corresponding plane of each side and of each end being parallel) and either with or without an inclined groove in its under surface by which a block may be keyed down by mastic.

23,422 of 1902.—C. NATHAN: *Bricks for Building and Other Purposes.*

A building system characterised by the interlocking of each endways contiguous and also each sideways contiguous stretcher with the header in such a manner that each header receives in its basal groove the contiguous end projections of two stretchers and the middle projection of one stretcher, and in its upper transverse grooves the tongues of the sideways contiguous stretchers of the next row whereby every brick is absolutely locked in its place independently of the mortar.

10,529 of 1903.—A. W. COOKSEY: *Radiators and the Like for Heating Buildings.*

This invention relates to radiators and the like in which the heated air is delivered through more or less vertical pipes or conduits into the room or space to be heated, the outlet ends of the said pipes or conduits being at the upper part of the apparatus, but it is also applicable to other forms of radiators. When radiators (more especially those of the kind above referred to) are situated near the wall of the room, the part of such wall above the outlet of the radiator soon becomes discoloured and unsightly, and the principal object of this invention is to obviate this objection. For this purpose the top of the radiator is furnished with a deflector or hood, consisting of a segmental or other conveniently shaped plate of iron or other metal, with closed ends, and furnished with flanges or other suitable means of removable connexion with the upper part of the radiator, the mouth or opening of the hood being more or less at right angles with the top of the radiator.

14,075 of 1903.—J. KEUSEN: *Adjustable Stove Pipes.*

This invention relates to stove pipes constructed in such a manner that the stove pipe can be easily adjusted to any required length without cutting it off. The invention consists in the combination of two pipes of different diameter one

telescoped into the other, an outwardly bent flange at the other end of the inner pipe, and an inwardly bent edge at the corresponding end of the outer pipe, and semi-circular outcuts in the flange and edge.

22,640 of 1902.—C. SHOWELL: *Casement Opening and Closing Mechanism.*

This invention relates to casement opening and closing mechanism, and refers more particularly to the construction and controlling of the arm by which the adjusted position of the casement is secured. Usually this arm is toothed on the inside, while its upper side has been held downwards by means of a flat roller. This has permitted an undesirable amount of side play and looseness, which this invention is intended to remedy. In this invention the back of the arm is made V shaped, or it may have a central V or similarly shaped groove, and with either of these, a controlling pulley is carried upon framework of the fitting; consequently the usual side-play to the arm is entirely prevented.

22,403 of 1902.—T. W. ROGERS: *Trapped Gullies.*

This invention relates more particularly to that type of water gullies that are known as yard gullies, namely, gullies that are fitted with a grid and are set at or near the level of the ground, and are adapted to receive one or more waste pipes from a house. This invention consists mainly in constructing the grid of the gully so that all the waste or other pipes pass vertically through the grid instead of horizontally through the sides of the pan or box of the gully, thereby enabling the gully to be placed close to the sides of the house or wall, and to give the waste pipes a vertical discharge into the trap, which makes the trap selfcleansing, and to construct the gully-box or pan without any branches. To this end the grid of the gully is constructed in two parts, one part, namely, the part next to the house or wall, is provided with lugs to fit lugs on the other part, and on the centre or meeting line of the two parts holes are provided adapted to receive the various waste pipes or waste pipe as the case may be.

MEETINGS.

SATURDAY, SEPTEMBER 19.

Northern Architectural Association. — Excursion meeting, Sunderland. Members to assemble at Sunderland Station at 3.11 p.m.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

September 8.—By A. E. GREEN & Co.

Shipley, Sussex.—Batchelor's Farm, 41 a. 3 r. 31 p., f.	£1,250
Billingshurst, Sussex.—Five Oaks, enclosure of land, 10 a. 2 r. 23 p., f.	300
By HAMMERSLEY, KENNEDY, & Co.	
Peckham.—55, 57, 59, and 61, Toppesfield-rd., u.t. 73 yrs., g.r. 16*l.* 16s., w.r. 145*l.* 12s.	900
By FRED. WARMAN.	
Highbury.—102, Highbury New Pk., u.t. 46 yrs., g.r. 22*l.* 10s., p.	1,185
Canonbury.—13, Marquess-rd., u.t. 41½ yrs., g.r. 10*l.*, e.r. 70*l.*	560
Highgate.—7, Whitehall Pk., u.t. 84½ yrs., g.r. 9*l.* 9s., p.	800
By AMEY BROS. (at Catford).	
Brockley.—58, Darfield-rd., u.t. 74¼ yrs., g.r. 4*l.*, w.r. 36*l.* 8s.	278
Catford.—137, Glenfarg-rd., u.t. 992 yrs., g.r. 3*l.* 16s. w.r. 27*l.* 6s.	190
103, 105, and 107, Sandhurst-rd., u.t. 992 yrs., g.r. 11*l.* 8s., w.r. 74*l.* 2s.	515
September 9.—By MARK LIELL & SON.	
Bromley-by-Bow.—39 to 49 (odd), Gale-st., u.t 58 and 38½ yrs., g.r. 17*l.* 5s., w.r. 140*l.* 8s...	360
14 to 20 (even), Box-st., u.t. 38½ and 67 yrs., g.r. 13*l.*, w.r. 114*l.* 8s.	240
Canning Town.—1, West-rd. (S.), u.t. 77 yrs., g.r. 3*l.* 7s. 2d., y.r. 40*l.* 6s.	145
By A. PREECE & SON.	
Islington.—8, Vincent-ter., f., y.r. 45*l.*	680
St. John's Wood.—14, Loudoun-rd., u.t. 22 yrs., g.r. 12*l.*, y.r. 80*l.*	600
Clapham.—22, Wirtemberg-st., u.t. 54½ yrs., g.r. 5*l.*, w.r. 36*l.* 8s.	335
By SIDDONS, WADE, & Co.	
Erith, Kent.—4 to 8, Glendale-rd., f., w.r. 110*l.* 10s.	1,250
23, 24, 27 to 30, Erith Villas, u.t. 45 yrs., g.r. 31*l.* 10s., w.r. 187*l.* 4s.	1,200
1 to 5, Crayford Villas, u.t. 45 yrs., g.r. 27*l.* 14s., w.r. 156*l.*	975
Belvedere, Kent.—15 to 21, 31 to 39 (odd), 18 to 24 (even), Poplar Mount, f., w.r. 304*l.* 4s.	3,475
40 to 50 (even), Stanmore-rd., f., w.r. 156*l.*...	1,810
25 to 59 (odd), Horsa-rd., f., w.r. 448*l.* 8s. ..	4,710
Brook-st., Ivy Cottage, f., e.r. 27*l.* 6s.	260
September 10.—By H. V. CHEW.	
Leytonstone.—6, Queen's-rd., f., y.r. 36*l.*	525
Lemna-rd., Mosborough, u.t. 79 yrs., g.r. 12*l.*, e.r. 65*l.*	525

Contractions used in these lists.—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; p. for possession; e.r. for estimated rental; w.r. for weekly rental; q.r. for quarterly rental; y.r. for yearly rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; la. for lane; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; av. for avenue; gdns. for gardens; yd. for yard; gr. for grove; b.h. for beer-house; p.h. for public-house; o. for offices; s. for shops.

PRICES CURRENT OF MATERIALS.

*** Our aim in this list is to give, as far as possible, the *average* prices of materials, not necessarily the lowest. Quality and quantity obviously affect prices—a fact which should be remembered by those who make use of this information.

BRICKS, &c.

	£ s. d.	
Hard Stocks	1 16 0	per 1,000 alongside, in river
Rough Stocks and Grizzles.....	1 13 0	" " "
Facing Stocks....	2 12 0	" " "
Shippers	2 5 0	" " "
Flettons	1 10 0	" " "
Red Wire Cuts ..	1 13 0	" at railway depôt
Best Fareham Red	3 12 0	" " "
Best Red Pressed Ruabon Facing	5 0 0	" " "
Best Blue Pressed Staffordshire ..	4 5 0	" " "
Do. Bullnose	4 11 0	" " "
Best Stourbridge Fire Bricks	4 8 0	" " "
GLAZED BRICKS.		
Best White and Ivory Glazed Stretchers.....	13 0 0	" " "
Headers	12 0 0	" " "
Quoins, Bullnose, and Flats.....	17 0 0	" " "
Double Stretchers	19 0 0	" " "
Double Headers..	16 0 0	" " "
One Side and two Ends.....	19 0 0	" " "
Two Sides and one End	20 0 0	" " "
Splays, Chamfered, Squints.....	20 0 0	" " "
Best Dipped Salt Glazed Stretchers and Headers	12 0 0	" " "
Quoins, Bullnose, and Flats.....	14 0 0	" " "
Double Stretchers	15 0 0	" " "
Double Headers..	14 0 0	" " "
One Side and two Ends.....	15 0 0	" " "
Two Sides and one End	15 0 0	" " "
Splays Chamfered, Squints.....	14 0 0	" " "
Second Quality White and Dipped Salt Glazed	2 0 0	" less than best.

	s. d.	
Thames and Pit Sand	6	0 per yard, delivered.
Thames Ballast	6	0 " "
Best Portland Cement	30	0 per ton, delivered.
Best Ground Blue Lias Lime..	20	6 " "

NOTE.—The cement or lime is exclusive of the ordinary charge for sacks.

Grey Stone Lime ..... 12s. 6d. per yard, delivered.
Stourbridge Fire-clay in sacks 27s. 6d. per ton at rly. dpt.

STONE.

	s. d.	
BATH STONE—delivered on road waggons, Paddington depôt	1	6½ per ft. cube.
Do. do. delivered on road waggons, Nine Elms depôt	1	8½ " "
PORTLAND STONE (20 ft. average)—		
Brown Whitbed, delivered on road waggons, Paddington depot, Nine Elms depot, or Pimlico Wharf	2	1 " "
White Basebed, delivered on road waggons, Paddington depot, Nine Elms depot, or Pimlico Wharf....	2	2½ " "

	s. d.	
Ancaster in blocks	1 11	per ft. cube, deld rly. depôt
Beer in blocks	1 6	" "
Grinshill " ...	1 10	" "
Darley Dale in blocks..	2 4	" "
Red Corsehill "	2 5	" "
Closeburn Red Freestone	2 0	" "
Red Mansfield "	2 4	" "

YORK STONE—*Robin Hood Quality.*

	s. d.	
Scappled random blocks	2 10	per ft. cube, deld. rly. depôt.
6 in. sawn two sides landings to sizes (under 40 ft. super.)	2 3	per foot super. "
6 in. Rubbed two sides Ditto, Ditto	2 6	" "
3 in. Sawn two sides slabs (random sizes)..	0 11½	" "
2 in. to 2½ in. Sawn one side slabs (random sizes)	0 7½	" "
1½ in. to 2 in. ditto, ditto	0 6	" "
Scappled random blocks	3 0	per ft. cube "
6 in. sawn two sides, landings to sizes (under 40 ft. sup.)	2 8	per ft. super. "
6 in. Rubbed two sides Ditto	—	" "
3 in. sawn two sides slabs (random sizes)	1 2	" "
2 in. self-faced random flags.....	0 5	" "
Hopton Wood (Hard Bed) in blocks	2 3	per ft. cube.
" " " 6 in. sawn both sides landings	2 7	per ft. super. deld. rly. depôt
" " " 3 in. do.	1 2½	" "

SLATES.

in.	in.	£ s. d.	
20×10	best blue Bangor..	13 2 6	per 1000 or 1200 at ry.dep
20×12	" " "	13 17 6	" "
20×10	best seconds "	12 15 0	" "
20×12	" " "	13 10 0	" "
16×8	best "	7 0 0	" "
20×10	best blue Portmadoc ..	12 5 0	" "
16×8	best blue Portmadoc	6 5 0	" "
20×10	best Eureka unfading green....	15 2 6	" "

PRICES CURRENT (*Continued*).

SLATES.

in.	in.	£ s. d.	
20×12	best Eureka unfading green....	17 2 6	per 1000 or 1200 at ry.dept.
18×10	" "	12 10 0	" "
16×8	" "	10 5 0	" "
20×10	permanent green	11 0 0	" "
18×10	" "	9 5 0	" "
16×8	" "	6 10 0	" "

TILES.

	s. d.	
Best plain red roofing tiles...	42 0	per 1,000, at rly. depôt.
Hip and valley tiles....	3 7	per doz.
Best Broseley tiles	50 0	per 1,000
Do. Ornamental Tiles	52 6	" "
Hip and valley tiles....	4 0	per doz.
Best Ruabon Red, brown or brindled Do. (Edwards)	57 6	per 1,000
Do. ornamental Do.	60 0	" "
Hip tiles	4 0	per doz.
Valley tiles.....	3 0	" "
Best Red or Mottled Staffordshire Do. (Peakes)	51 9	per 1,000
Do. Ornamental Do.	54 6	" "
Hip tiles	4 1	per doz.
Valley tiles.....	3 8	" "
Best "Rosemary" brand plain tiles	48 0	per 1,000
Do. Ornamental Do.	50 0	" "
Hip tiles	4 0	per doz.
Valley tiles	3 8	" "

WOOD.

	At per standard. £ s. d.	£ s. d.	
Deals: best 3 in. by 11 in. and 4 in. by 9 in. and 11 in.....	15 10 0	16 10 0	
Deals: best 3 by 9.....	14 10 0	15 10 0	
Battens: best 2½ in. by 7 in. and 8 in., and 3 in. by 7 in. and 8 in.....	11 10 0	12 10 0	
Battens: best 2½ by 6 and 3 by 6 ..	0 10 0	less than 7 in. and 8 in.	
Deals: seconds	1 0 0	less than best	
Battens: seconds	0 10 0	" " "	
2 in. by 4 in. and 2 in. by 6 in. ..	9 0 0	9 10 0	
2 in. by 4½ in. and 2 in. by 5 in. ..	8 10 0	9 10 0	
Foreign Sawn Boards—			
1 in. and 1¼ in. by 7 in.	0 10 0	more than battens.	
¾ in.	1 0 0	"	
Fir timber: Best middling Danzig or Memel (average specification	At per load of 50 ft. 4 10 0	5 0 0	
Seconds	4 5 0	4 10 0	
Small timber (8 in. to 10 in.)	3 12 6	3 15 0	
Small timber (6 in. to 8 in.).....	3 0 0	3 10 0	
Swedish balks	2 15 0	3 0 0	
Pitch-pine timber (30 ft. average)..	3 5 0	3 15 0	
JOINERS' WOOD.			
White Sea: First yellow deals, 3 in. by 11 in.....	At per standard. 23 0 0	24 0 0	
3 in. by 9 in.	21 0 0	22 10 0	
Battens, 2½ in. and 3 in. by 7 in.	17 0 0	18 10 0	
Second yellow deals, 3 in. by 11 in.	18 10 0	20 0 0	
" " 3 in. by 9 in.	17 10 0	19 0 0	
Battens, 2½ in. and 3 in. by 7 in.	13 10 0	14 10 0	
Third yellow deals, 3 in. by 11 in. and 9 in.	15 10 0	16 10 0	
Battens, 2½ in. and 3 in. by 7 in.	11 10 0	12 10 0	
Petersburg: first yellow deals, 3 in. by 11 in.	21 0 0	22 10 0	
Do. 3 in. by 9 in.....	18 0 0	19 10 0	
Battens.....	13 10 0	15 0 0	
Second yellow deals, 3 in. by 11 in.....	16 0 0	17 0 0	
Do. 3 in. by 9 in.	14 10 0	16 0 0	
Battens.....	11 0 0	12 10 0	
Third yellow deals, 3 in. by 11 in.....	13 10 0	14 0 0	
Do. 3 in. by 9 in.	13 0 0	14 0 0	
Battens	10 0 0	11 0 0	
White Sea and Petersburg:—			
First white deals, 3 in. by 11 in.	14 10 0	15 10 0	
" " 3 in. by 9 in.	13 10 0	14 10 0	
Battens.....	11 0 0	12 0 0	
Second white deals 3 in. by 11 in.	13 10 0	14 10 0	
" " " 3 in. by 9 in.	12 10 0	13 10 0	
" " " battens.....	9 10 0	10 10 0	
Pitch-pine: deals	16 0 0	18 0 0	
Under 2 in. thick extra	0 10 0	1 0 0	
Yellow Pine—First, regular sizes ..	33 0 0	upwards.	
Oddments	22 0 0	24 0 0	
Seconds, regular sizes	24 10 0	26 10 0	
Yellow Pine Oddments	20 0 0	22 0 0	
Kauri Pine—Planks, per ft. cube..	0 3 6	0 4 6	
Danzig and Stettin Oak Logs—Large, per ft. cube	0 2 6	0 3 6	
Small " "	0 2 3	0 2 6	
Wainscot Oak Logs, per ft. cube ..	0 5 0	0 5 6	
Dry Wainscot Oak, per ft. sup. as inch	0 0 7	0 0 8	
¾ in. do. do.	0 0 5½	. . .	
Dry Mahogany—Honduras, Tabasco, per ft. sup. as inch	0 0 9	0 0 11	
Selected, Figury, per ft. sup. as inch	0 1 6	0 2 0	
Dry Walnut, American, per ft. sup. as inch	0 0 10	0 1 0	
Teak, per load	17 0 0	21 0 0	
American Whitewood Planks— Per ft. cube	0 4 0	. . .	
Prepared Flooring—	Per square.		
1 in. by 7 in. yellow, planed and shot.....	0 13 6	0 17 6	
1 in. by 7 in. yellow, planed and matched.....	0 14 0	0 18 0	
1¼ in. by 7 in. yellow, planed and matched.....	0 16 0	1 1 6	
1 in. by 7 in. white, planed and shot.....	0 11 6	0 13 6	
1 in. by 7 in. white, planed and matched.....	0 12 0	0 14 0	
1¼ in. by 7 in. white, planed and matched.....	0 14 6	0 16 6	
¾ in. by 7 inch yellow matched and beaded (or V-jointed boards	0 11 0	0 13 6	
1 in. by 7 in. do. do. do.	0 14 0	0 18 0	
¾ in. by 7 in. white do. do.	0 10 0	0 11 6	
1 in. by 7 in. do. do. do.	0 11 6	0 13 6	

6-in. at 8d. to 9d. per square less than 7-in.

[*See also page 305.*

COMPETITIONS, CONTRACTS AND PUBLIC APPOINTMENTS.

(For some Contracts, &c., still open, but not included in this List, see previous issues.)

COMPETITION.

Nature of Work.	By whom Advertised.	Premiums.	Designs to be delivered
*Reconstruction of Cattle Market	Governors Wakefield Charities	50 guineas and 25 guineas	Dec. 1

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Forms of Tender, &c., supplied by	Tenders to be delivered
*Rebuilding House, Butcher-row, Ratcliff, Stepney, E.	Messrs J. Symons & Co., Ltd.	C. Dunch, Architect, St. Clement's House, Lombard street, E.C.	Sep. 21
*Road-making and Paving Works	Willesden District Council	Council's Engineer, Dyne-road, Kilburn, N.W.	Sep. 22
Laundry, &c., at Hospital, Poulton	Dover Town Council	H. E. Stilgoe, Civil Engineer, Town Hall, Dover	do.
Street Works	Andover Corporation	T. E. Longman, Town Hall, Andover	do.
House, Sedbergh	Lancaster Banking Co., Ltd.	J. Parkinson, Architect, 67, Church-street, Lancaster	do.
Reservoir, White Loch, Mearns	Stewarton (N.B.) Town Council	W. R. Copland, Civil Engineer, 146, West Regent-street, Glasgow	do.
Forty-three Houses, Abertridwr	.....	G. A. Lundie, Architect, Queen-street, Cardiff	do.
Three Houses, Hullen Edge-lane, Halifax	.....	F. H. Beaumont, Architect, Southgate Chambers, Halifax	do.
Tenements, Adelphi and other streets	Glasgow Corporation	City Engineer, 64, Cochrane-street, Glasgow	do.
Police Station, St. Andrew's-square	do.	do.	do.
School, Maindy, near Cardiff	Llandaff School Board	G. E. Halliday, Architect, 14, High-street, Cardiff	do.
Schools	Llangincke School Board	J. D. Rees, Architect, Ystalyfera, Wales	Sep. 23
Three Cottages, 72, 74, 76, Silk-street, Oldham-road	Manchester Corporation	City Architect, Town Hall, Manchester	do.
Road Works, Airedale-avenue and Compton-crescent	Chiswick U.D.C.	J. Barclay, Surveyor, Town Hall, Chiswick	do.
Paving Works, Back Wickham-street and others	Leeds Corporation	City Engineer, Municipal Offices, Leeds	do.
Road Works, Binchester Whins	Auckland Joint Hospital Board	C. Johnston, Surveyor, Cradock-street, Bishop Auckland	do.
Road Works, Marlborough-road	Cardiff Corporation	W. Harpur, Civil Engineer, Town Hall, Cardiff	do.
Additions to Lodge, People's Park	Limerick (Ireland) Corporation	W. M. Nolan, Town Hall, Limerick	do.
Twenty-nine Houses, Rowles-square, Rhymney, Wales	Victoria Building Club	W. H. Trump, Rhymney	do.
*Supply of White Flare Burnt Chalk Lime	Commercial Gas Company	Engineer, Company's Offices, Stepney, E.	do.
*Purchase of Retort Carbon	do.	do.	do.
*Purchase of Surplus Breeze	do.	do.	do.
Works at Schools, Saltash	.....	J. H. Pooley, 104, Fore-street, Saltash	Sep. 24
Road Works, Craig-Berthlwyd, Treharris	.....	W. Dowdeswell, Architect, Treharris	do.
Hall, Middleton, King's Lynn	.....	S. H. Hewings, 38, Saddlebow-road, King's Lynn	do.
Drainage Works, Lime Tree-place	Stowmarket (Suffolk) U.D.C.	G. W. Lingwood, Surveyor, Station-road, Stowmarket	do.
Drainage Works, Wymington	Bedford R.D.C.	Mark Sharman, 1, Harpur-street, Bedford	do.
R building Chimney at Dispensary	Kilkenny (Ireland) Guardians	K. Comerford, Union Offices, Kilkenny	do.
Street Works, &c. (Contracts 1, 2, 3.)	Ebbw Vale U.D.C.	T. J. Thomas, Surveyor, Drill Ground, Ebbw Vale	do.
Schoolroom at Chapel, Hendrefelin (Wales)	.....	T. Morgan, Penffyon, Pontrhydygroes	Sep. 25
Street Works, Lowther-street	Nelson (Lancs) Corporation	B. Ball, Civil Engineer, Town Hall, Nelson	do.
Road Works, New-street, near Barnsley	Dodworth U.D.C.	P. A. Hinchcliffe, Architect, 14, Regent-street, Barnsley	do.
Schools, Crossness, Abbey Wood, Kent	Erith Education Committee	W. Egerton, Architect, 12, Queen's-road, Erith	do.
Sewers, &c., New Swannington	Ashby-de-la-Zouch District Council	S. Turner, Surveyor, Avenue-road, Ashby-de-la-Zouch	do.
Converting St. James' Manse into Schools, &c.	.....	Geo. Reavell, Junr., Architect, Ainwick	Sep. 26
Wesleyan Church and Schools, Saltburn	.....	Garside & Pennington, Architects, Pontefract	do.
Reconstruction of Morton Bridge	Eccles (Lancs) Corporation	C. S. Allott & Son, Engineers, 46, Brown-street, Manchester	do.
Rebuilding the Cross Keys Inn, Skewen, Wales	Mr. E. E. Bevan	J. Cook Rees, Architect, Neath	do.
Two Cottages, Shenfield, Essex	.....	L. H. Marshall, Surveyor, Chippenham	do.
Broken Granite	Shoreham (Sussex) U.D.C.	F. Slaughter, Surveyor, West-street, Shoreham	do.
Granite Road Metal, &c.	do.	do.	do.
Pumping Station, Pigeon House-road	Dublin Corporation	G. Chatterton, Civil Engineer, 6, The Sanctuary, Westminster	do.
Ten Houses, Fochriw, Wales	.....	W. Walters, 5, Dynevor-street, Fochriw	Sep. 28
Seventeen Houses, Gilfach Bargoed	Park Place Building Club	W. Harris, Architect, Gilfach, Pengam	do.
Broken Granite Road Metal (600 tons)	Guildford Town Council	C. G. Mason, Civil Engineer, Tansgate, Guildford	do.
Sewerage Works, Ripley (Surrey)	Guildford R.D.C.	J. Austee, Civil Engineer, Commercial-road, Guildford	do.
Private Improvement Works, Ivy-ter. & Terminus-rd.	Eastbourne Corporation	D. J. Bowe, Borough Surveyor, Town Hall, Eastbourne	do.
Clock Tower at Market Hall	Nelson (Lancs) Corporation	B. Ball, Civil Engineer, Town Hall, Nelson	do.
Portland Cement, &c.	Cowes (Isle of Wight) U.D.C.	J. W. Webster, Engineer, High-street, Cowes	do.
Sewers, Clifton, York	Visiting Committee	Fairbank & Son, Civil Engineers, Lendal, York	do.
Schools, Maesycwmmer School Board	Bedwas School Board	J. H. Phillips, Architect, Windsor-place, Cardiff	do.
Water Supply Works, Martock	Yeovil R.D.C.	Bailey, Denton, & Co., Civil Engineers, 9, Bridge-st., Westminster	do.
Paving Works	Walthamstow U.D.C.	G. W. Holmes, Civil Engineers, Town Hall, Walthamstow	Sep. 29
Fencing, &c., Whitefield Farm, Ogbourne St. George	Swindon Corporation	A. J. Hamp, Borough Surveyor, Town Hall, Swindon	do.
*Broken Granite	Hanwell U.D.C.	Council's Offices, Hanwell, W.	do.
Wrought Iron Fencing	Wood Green U.D.C.	C. J. Gunyon, Civil Engineer, Town Hall, Wood Green	do.
Additions to Boiler House, Elec. Light Sta., Pine-grove	Bootle (Lancs) Corporation	B. J. Wolfenden, Civil Engineer, Town Hall, Bootle, Lancs	do.
Chapel, Longwick, near Princes Risborough	.....	F. Taylor, Architect, Temple-street, Aylesbury	do.
*New Sorting Office, Ealing Dean	H.M. Office of Works	J. Wager, H.M. Office of Works, Storey's Gate	do.
*Ealing Telephone Exchange	do.	do.	do.
*Corrugated Iron Sheds	Walthamstow U.D.C.	Council's Engineer, Town Hall, Walthamstow	do.
*New Coast Guard Buildings, Isles of Scilly	Admiralty	Superintending Civil Engineer, H.M. Dockyard, Devonport	Oct. 2
*Repairing, &c. Bidings., Abbey Mills Pumping Station	London County Council	Engineer's Department, County Hall, Spring Gardens, S.W.	Oct. 6
Cottage Homes for Disabled Soldiers, Blackburn	.....	M'Call & Robinson, Architects, 7, Tacketts-street, Blackburn	No date.
House, Clacton-on-Sea	Mr. J. T. Lack	G. Gardiner, Architect, 11, Marine Parade, Clacton	do.
House, Evenwood, Durham	Mr. A. Maddison	Pegg & Farrow, Architects, 7, Market-place, Barnard Castle	do.
Kerbing Water, High Street, Lavenham	Cosford R.D.C.	E. W. Veale, Civil Engineer, Bildeston	do.
Twenty Cottages, Purfleet, Essex	.....	V. Millett, 72, B shopsgate-street Within, E.C.	do.
Farmhouse, Parmal Ash, Harrogate	.....	Bolshaw & Stevens, Architects, 1, Princes-street, Harrogate	do.
Additions to Schools, Maesycwmmer	Bedwas School Board	Not stated	do.
Flags, Kerbs, &c.	Hipperholme (Yorks) U.D.C.	G. W. Thompson, Surveyor, Hipperholme	do.

PUBLIC APPOINTMENT.

Nature of Appointment.	By whom Advertised.	Salary.	Application to be in
*Superintendent of Works	Herne Bay U.D.C.	Not stated	Sep. 30

Those marked with an asterisk (*) are advertised in this Number. *Competition*, iv. ‖ *Contracts*, iv. vi. viii. & x. ∴ *Public Appointments*, xvii. & xix.

PRICES CURRENT (*Continued*).

JOISTS, GIRDERS, &c.

	In London, or delivered Railway Vans, per ton. £ s. d.	£ s. d.
Rolled Steel Joists, ordinary sections	6 5 0	7 5 0
Compound Girders " "	8 2 6	9 5 0
Angles, Tees and Channels, ordinary sections	7 17 6	8 17 6
Flitch Plates	8 5 0	8 15 0
Cast Iron Columns and Stanchions, including ordinary patterns	7 2 6	8 5 6

METALS.

	Per ton, in London. £ s. d.	£ s. d.
IRON—		
Common Bars	7 10 0	8 0 0
Staffordshire Crown Bars, good merchant quality	8 0 0	8 10 0
Staffordshire "Marked Bars"	10 10 0	- - -
Mild Steel Bars	8 15 0	9 5 0
Hoop Iron, basis price	9 0 0	9 5 0
" " galvanised	16 0 0	- -
(* And upwards, according to size and gauge.)		
Sheet Iron, Black.—		
Ordinary sizes to 20 g.	9 15 0	- - -
" " to 24 g.	10 15 0	- - -
" " to 26 g.	12 5 0	- - -
Sheet Iron, Galvanised, flat, ordinary quality—		
Ordinary sizes, 6 ft. by 2 ft. to 3 ft. to 20 g.	12 15 0	- - -
" " 22 g. and 24 g.	13 5 0	- - -
" " 26 g.	14 5 0	- - -
Sheet Iron, Galvanised, flat, best quality:—		
Ordinary sizes to 20 g.	16 0 0	- - -
" " 22 g. and 24 g.	16 10 0	- - -
" " 26 g.	18 0 0	- - -
Galvanised Corrugated Sheets:—		
Ordinary sizes, 6 ft. to 8 ft. 20 g.	12 15 0	- - -
" " 22 g. and 24 g.	13 5 0	- - -
" " 26 g.	14 0 0	- - -
Best Soft Steel Sheets, 6 ft. by 2 ft. to 3 ft. by 20 g. and thicker	12 15 0	- - -
" " 22 g. and 24 g.	12 15 0	- - -
" " 26 g.	14 0 0	- - -
Cut nails, 3 in. to 6 in. (Under 3 in. usual trade extras.)	9 5 0	9 15 0

LEAD, &c.

	Per ton, in London. £ s. d.	£ s. d.
LEAD—Sheet, English, 3 lbs. & up.	14 0 0	- - -
Pipe in coils	14 10 0	- - -
Soil pipe	17 0 0	- - -
Compo Pipe	17 0 0	- - -
ZINC—Sheet—		
Vieille Montagne ton	26 0 0	- - -
Silesian	25 15 0	- - -
COPPER—		
Strong Sheet per lb.	0 0 10½	- - -
Thin "	0 0 11½	- - -
Copper nails "	0 0 11	- - -
BRASS—		
Strong Sheet per lb.	0 0 10	- - -
Thin "	0 0 11	- - -
TIN—English Ingots "	0 1 4	- - -
SOLDER—Plumbers' "	0 0 6	- - -
Tinmen's "	0 0 8	- - -
Blowpipe "	0 0 9	- -

ENGLISH SHEET GLASS IN CRATES.

15 oz. thirds	2½d. per ft. delivered.
" fourths	2¾d. " "
21 oz. thirds	3½d. " "
" fourths	3¾d. " "
26 oz. thirds	3¾d. " "
" fourths	4¼d. " "
32 oz. thirds	4¾d. " "
" fourths	5¼d. " "
Fluted sheet, 15 oz.	2¾d. " "
" 21 oz.	3½d. " "
½d Hartley's Rolled Plate	1¾d. " "
⅝ " " "	2d. " "
¾ " " "	2¼d. " "

OILS, &c.

	£ s. d.
Raw Linseed Oil in pipes or barrels.. per gallon	0 1 10
" " " in drums	" 0 2 2
Boiled " " in pipes or barrels..	" 0 2 1
" " " in drums	" 0 2 5
Turpentine, in barrels	" 0 3 3
" in drums	" 0 3 10
Genuine Ground English White Lead	per ton 19 0 0
Red Lead, Dry	" 19 0 0
Best Linseed Oil Putty	per cwt. 0 3 0
Stockholm Tar	per barrel 1 12 0

VARNISHES, &c.

	Per gallon. £ s. d.
Fine Pale Oak Varnish	0 3 0
Pale Copal Oak	0 10 6
Superfine Pale Elastic Oak	0 12 6
Fine Extra Hard Church Oak	0 10 0
Superfine Hard-drying Oak, for Seats of Churches	0 14 0
Fine Elastic Carriage	0 12 6
Superfine Pale Elastic Carriage	0 16 0
Fine Pale Maple	0 16 0
Finest Pale Durable Copal	0 18 0
Extra Pale French Oil	1 1 0
Eggshell Flatting Varnish	0 18 0
White Copal Enamel	1 4 0
Extra Pale Paper	0 12 0
Best Japan Gold Size	0 10 6
Best Black Japan	0 16 0
Oak and Mahogany Stain	0 9 0
Brunswick Black	0 3 6
Berlin Black	0 16 0
Knotting	0 10 0
French and Brush Polish	0 10 0

PUBLISHER'S NOTICES.

THE INDEX (with TITLE-PAGE) for VOLUME LXXXIV. (January to June, 1903) was given as a supplement with the number for July 11.

CLOTH CASES for Binding the Numbers are now ready, price 1s. 6d. each; also

READING CASES (Cloth), with Strings, price 9d. each.

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*** Stamps must not be sent, but all sums should be remitted by Postal Orders, payable to J. MORGAN, and addressed to the Publisher of "THE BUILDER," Catherine-street, W.C.

Advertisements for the current week's issue are received up to THREE o'clock p.m. on THURSDAY, but "Classification" is impossible in the case of any which may reach the Office after HALF-PAST ONE p.m. on that day. Those intended for the Outside Wrapper should be in by TWELVE noon on WEDNESDAY.

ALTERATIONS IN STANDING ADVERTISEMENTS or ORDERS TO DISCONTINUE same must reach the Office before TEN o'clock on WEDNESDAY MORNING.

The Publisher cannot be responsible for DRAWINGS, TESTIMONIALS, &c. left at the Office in reply to advertisements, and strongly recommends that of the latter COPIES ONLY should be sent.

PERSONS Advertising in "The Builder" may have *Replies addressed to the Office*, Catherine-street, Covent Garden, W.C. *free of charge*. Letters will be forwarded if addressed envelopes are sent, together with sufficient stamps to cover the postage. Unused stamps are returned to advertisers the week after publication.

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TERMS OF SUBSCRIPTION.

"THE BUILDER" (Published Weekly) is supplied DIRECT from the Office to residents in any part of the United Kingdom, at the rate of 19s. per annum (52 numbers) PREPAID. To all parts of Europe, America, Australia, New Zealand, India, China, Ceylon, &c., 26s. per annum. Remittances (payable to J. MORGAN) should be addressed to the publisher of "THE BUILDER," Catherine-street, W.C.

SUBSCRIBERS in LONDON and the SUBURBS, by prepaying at the Publishing Office 19s. per annum (52 numbers) or 4s. 9d. per quarter (13 numbers) can ensure receiving "The Builder" by *Friday Morning's Post*.

TO CORRESPONDENTS.

NOTE.—The responsibility of signed articles, letters, and papers read at meetings rests, of course, with the authors.

We cannot undertake to return rejected communications.

Letters or communications (beyond mere news items) which have been duplicated for other journals are NOT DESIRED.

All communications must be authenticated by the name and address of the sender, whether for publication or not. No notice can be taken of anonymous communications.

We are compelled to decline pointing out books and giving addresses.

Any commission to a contributor to write an article, or to execute or lend a drawing for publication, is given subject to the approval of the article or drawing, when received, by the Editor, who retains the right to reject it if unsatisfactory. The receipt by the author of a proof of an article in type does not necessarily imply its acceptance.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; those relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and *not* to the Editor.

TENDERS.

Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than* 10 *a.m. on Thursdays*. [N.B.—We cannot publish Tenders unless authenticated either by the architect or the building-owner; and we cannot publish announcements of Tenders accepted unless the amount of the Tender is given, nor any list in which the lowest Tender is under 100*l.*, unless in some exceptional cases and for special reasons.]

* Denotes *accepted*. † Denotes *provisionally accepted*.

ALNWICK.—For the execution of sewerage works, &c., South Main-road, for the Urban District Council. Mr. Geoffrey Wilson, town surveyor, Green Bat, Alnwick:—

McLaren & Co. £123 0
J. & G. Green, Ackilngton* 114 10
[Pipes in stock to be allowed for, if used.]

AYLESBURY.—Accepted for the construction of sewage disposal works for the Urban District Council. Mr. G. Chatterton, C.E., 6, The Sanctuary, Westminster, S.W.:—

Cooke & Co., 16, Victoria-street, S.W. £11,546

BRISTOL.—For the erection of the Bell Inn, Two Mile Hill, for Messrs. W. J. Rogers, Ltd. Messrs. C. & C. Thompson, architects, Athenæum-chambers, Nicholas-street, Bristol. Quantities by Mr. H. G. Pearson, Bristol:—

J. James	£3,100	Eastabrook & Sons	£2,718
H. A. Forse	3,060	R. Love	2,700
James & Hill	2,885	S. Williams	2,550
M. Durnford	2,820	Denby & Co.*	2,528
F. Chown	2,749	[All of Bristol.]	

COWPEN (Northumberland).—For reconstructing about 2,170 lineal yards of 12-in., 9-in., and 4-in. earthenware pipe sewers and drains, building manholes, lampholes, flushing chambers, &c., at Bebside, within the district of Cowpen Urban District Council. Robert Grieves, engineer and surveyor:—

D. W. Richards	£840 0 2	Tough Bros.	£554 1 10
J. Hollings	754 6 0	G. E. Simpson	548 17 9
J. Coxon	658 3 7	J. Shannon	531 19 4
Johnson Bros.	633 0 9	Maclaren & Co.	516 6 6
W. Carr	626 7 4	J. Robson, Newcastle-on-Tyne*	513 5 0
J. Maclaren	562 7 10		

CROYDON.—For new cookery and laundry centre at the Ecclesbourne-road Schools for the Croydon School Board. Mr. Robert Ridge, Surveyor to the Board, architect. Quantities by Mr. Mansfield Price:—

Funnell & Co.	£1,853 18 6	W. Smith & Sons*	£1,743 0 0
J. Smith & Sons	1,784 0 0	Bulled & Co.	1,739 0 0

CROYDON.—For alterations and additions and providing 404 additional places in the boys', girls', and juniors' departments at the Whitehorse-road schools for the Croydon School Board. Mr. Robert Ridge, architect. Quantities by Messrs. Downing & Haskins:—

J. Smith & Sons	£3,947 0	W. Smith & Sons	£3,890 0
Funnell & Co.	3,942 15	Bulled & Co.*	3,625 0

GOLDTHORPE (Yorks).—Accepted for the erection of schools and caretakers' house for the Bolton-upon-Dearne School Board. Mr. R. Higginbottom, Thurnsco, and Mr. W. H. Wagstaff, A.M.Inst.C.E., Chesterfield, joint architects:—

Thornton & Son, Rotherham.

GUILDFORD.—For the construction of an underground convenience, North-street, for the Town Council. Mr. C. G. Mason, C.E., Tuns Gate, Guildford:—

R. Smith	£1,298 0	Streeter & Tod-hunter	£1,158 10
A. & F. Gammon	1,298 0	Mitchell Bros.	1,138 0
W. G. Edward	1,237 0	Swayne & Son, Guildford*	1,035 0
Tribe & Robinson	1,205 0		
R. Wood	1,182 0		

HALIFAX.—For the erection of a three-storied warehouse, shop, &c., King-street. Messrs. Jackson & Fox, architects, Rawson-street, Halifax:—

Masonry.—T. Pickles, Luddenden Foot	£927 0
Joinery.—S. Greenwood, Boothtown, Halifax	374 5
Ironfounders' Work.—J. Berry, New Bank, Halifax	160 0
Plumbing.—J. Naylor & Son, Cheapside, Halifax	100 0
Plastering.—Lumb Bros, King Cross, Halifax	99 10
Painting.—S. Ackroyd, Queen's-road, Halifax	19 10

NEEDHAM MARKET (Suffolk).—For laying concrete paving, &c. Mr. H. Miller, C.E., 16, Museum-street, Ipswich:—

G. Burgoyne, Ipswich, 3s. 6d. per sup. yd. for slabs.

NORBURY.—For the erection of six houses, Fairview-road. Mr. Herbert Bignold, architect and surveyor, 242, Lavender Hill, London, S.W.:—

C. Wh Ilier	£2,100	J. Wright Hallett*	£2,045
Sims & Wood	2,040		

PAKEFIELD.—For the erection of rectory House. Mr. Herbert Bignold, architect and surveyor, 242, Lavender Hill, London, S.W.:—

Sims & Wood* £2,150

PETERHEAD (N.B.)—Accepted for additions to North Public School, for the School Board. Mr. A. Clyne, architect, 123½, Union-street, Aberdeen. Quantities by the architect:—

Masonry.—W. West	£768 15 0
Carpentry.—A. & J. Webster	778 0 0
Plumbing.—J. Ferguson	263 2 5
Slating.—A. Fordyce	127 19 0
Plastering.—Stuart & Co.	292 18 6
Painting and Glazing.—W. G. Calder	14 0 0
	£2,280 14 11

[A 1 of Peterhead.]

[*See also next page.*

PONTYPRIDD.—For the erection of public offices, Morgan-street, for the Urban District Council. Mr. H. T Hare, architect, 13, Hart-street, London W.C. Quantities by Mr. R. B. Hogg, 10, John-street, Adelphi :—

W. Davis	£16,317	Lattey & Co.	£13,372
D. Davis	15,500	Hughes & Stirling	12,960
Holloway Bros.	15,050	Willcock & Co.	12,950
Turner & Sons	14,088	W. Williams, Cardiff*	12,490
Morgan & Co.	13,500		

PRESTON (Lancs.).—For the erection of a power-station, car sheds, Holmrook-road and Sussex-street East, for the Corporation. Mr. W. H. Tittensor, engineer, 25, Burrow-road, Preston—

T. B. Garnett, Preston £11,272 19 4

SELLY OAK (Warwicks).—For the erection of a boiler-house, for the King's Norton Union Guardians. Messrs. C. Whitwell & Son, architects, Temple-row, Birmingham :—

Whitehouse & Sons	£3,145	W. Robinson	£2,920
G. Goodwin	3,119	H. Dorse	2,865
Sapcote & Sons	3,098	W. Harvey Gibbs, King's Heath*	2,840
A. Colin Hughes	2,992		
Dallow & Sons	2,980		

SIDBURY (Salop).—For the erection of a house, for the Rev. J. B. Clutterbuck. Messrs. Barrett & Driver, architects, 23, York-place, Baker-street, W. :—

Wilcock & Co.	£2,450	Estcourt & Sons Gloucester†	£2,100
Morris & Sons	2,280		
H. Smith	2,144		

STOURBRIDGE.—For the erection of Cottage homes. Mr. A. Marshall, A.R.I.B.A., Nottingham, architect :—

C. A. Horton	£14,783	W. Crane	£10,900
W. Pattinson	12,243	W. H. Gibbs	10,900
Vickers	12,170	Guest & Son	10,800
Simmons	12,000	Dallow & Son	10,550
J. A. Meredith	11,964	Moss & Son	10,456
G. H. Marshall	11,700	Fish & Son	10,356
T. Hardy	11,395	Hadley & Son	10,205
H. Dorse†	11,150	Griffiths, Lye, Stourbridge*	10,180
Hutchinson	11,100	F. Evans	10,100
W. North	10,981	W. Hopkins	10,000
Willcock & Co.	10,970	Vickers & Son	9,800
J. & A. Bragier	10,900		

STOURBRIDGE.—For the erection of a workhouse. Mr A. Marshall, A.R.I.B.A., Nottingham, architect :—

C. A. Horton	£143,224 0 0	W. Hopkins	£104,000 0 0
W. Pattinson	123,243 0 0	Vickers & Son	103,000 0 0
J. Hutchinson	112,400 0 0	Hadley & Son	102,700 0 0
H. Dorse	110,000 0 0	Dallow & Son	99,900 0 0
W. H. Gibbs	109,900 0 0	Crane & Co.	99,500 0 0
Vickers & Co.	109,815 17 5	Moss & Son	97,885 0 0
Guest & Son	109,300 0 0	F. Evans, Nottingham*	95,550 0 0
Willcock & Co.	108,775 0 0		
Fish & Sons	106,352 0 0		

SWINDON.—For making up private streets. Mr. J. Hamp, Borough Surveyor :—

Name of Contractor.	Ashford-road. £ s. d.	Maidstone-road. £ s. d.	Rosebery-street. £ s. d.	Graham-street. £ s. d.
Free Bros., Marlboro'*	658 2 8	125 19 8	358 12 9	355 16 2
A. J. Colborne	692 12 0	143 16 7	386 8 11	387 1 10
Free & Sons	746 8 4	147 14 11	401 0 8	398 5 4
Free & Co.	750 14 5	146 3 8	394 16 4	401 1 11
Winchcombe	710 13 1	134 10 2	374 17 8	374 18 11
S. Chambers	820 0 0	165 0 0	—	—
Boro' Surveyor's estim.	727 17 7	141 16 5	393 14 3	395 6 9

TOOTING.—For fire-resisting works at the Fountain Hospital, for the Metropolitan Asylums Board. Messrs. T. W. Aldwinckle & Son, architects, 20, Denman-street, S.E. Quantities supplied :—

Ferguson & Co.	£15,300	Johnson & Co. Ltd.	£13,450
Lawrence & Co.	14,392	E. Chamberlain	13,050
Wall & Co.	14,049	Roberts & Co.*	12,950
F. & H. F. Higgs	13,800		

WHICKHAM (Co. Durham).—For the erection of Council Offices, &c., for the Urban District Council. Mr. J. B. Renton, surveyor, Council Offices, Whickham :—

W. B. Collin	£4,500 0 0	Turner & Co., Gateshead*	£3,833 16 1
I. Bewley	4,466 0 0	D. D. Hall	3,599 2 2
J. A. M. Henderson	4,077 9 9	[Estimate, £4,000].	

WOODHOUSE (Yorks.).—For the erection of club premises for the North-West Liberal Club. Messrs. Buttery & Birds, architects, 1, Basinghall-square, Leeds. Quantities by the architects :—

Masonry and Bricklaying.—Myers & Sons	£570 0 0
Carpentry and Joinery.—J. Burn	433 13 0
Plumbing.—H. Boston	78 10 0
Plastering.—W. Watson	110 0 0
Slating.—Atkinson & Son	47 12 0
[All of Leeds.]	
Heating Apparatus.—Blakeborough & Rhodes, Stockton-on-Tees	62 2 6

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